

APPENDIX III

TAB K

Kevin Padian

SHEET 1 PAGE 1

00001
 1 IN THE UNITED STATES DISTRICT COURT
 2 FOR THE MIDDLE DISTRICT OF PENNSYLVANIA
 3 TAMMY KITEMILLER, et al.,
 4
 5 Plaintiffs,
 6
 7 vs. No. CV 04-2638
 8
 9 DOVER AREA SCHOOL DISTRICT;
 10 DOVER AREA SCHOOL DISTRICT
 11 BOARD OF DIRECTORS,
 12
 13 Defendants.
 14
 15 DEPOSITION OF KEVIN PADIAN
 16 Oakland, California
 17 Tuesday, May 10, 2005
 18 Reported by:
 19 ANA WIDA REID
 20 CSR No. 11926
 21 JCS No. 52669
 22
 23
 24
 25

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 1 APPEARANCES:
 2
 3 For Plaintiff:
 4
 5 PEPER HAMILTON
 6 BY: ERIC ROTHSCCHILD
 7 Attorney at Law
 8 3030 Two Logan Square Eighteenth & Arch Streets
 9 Philadelphia, PA 19102
 10 (215) 981-4000
 11 For Defendants:
 12 THOMAS MORE LAW CENTER
 13 BY: PATRICK GILLEN
 14 Attorney at Law
 15 24 Frank Lloyd Wright Dr.
 16 P.O. Box 393
 17 Ann Arbor, MI 48106
 18 (734) 827-2001
 19
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Deposition of KEVIN PADIAN taken on
 behalf of Defendants at 1999 Harrison
 Street, Oakland, California, beginning at
 9:28 a.m. and ending at 3:52 p.m. on
 Tuesday, May 10, 2005, before ANA WIDA REID,
 Certified Shorthand Reporter No. 11926

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1 Oakland, California, Tuesday, May 10, 2005
 2 9:28 a.m. - 1:52 p.m.
 3
 4 KEVIN PADIAN,
 5 having been first duly sworn, was examined and testified
 6 as follows:
 7
 8 EXAMINATION

9
 10 BY MR. GILLEN:

11 Q Good morning, Dr. Padian. My name is Patrick
 12 Gillen. We met off the record, but let me introduce
 13 myself again for the purposes of the record. I'm an
 14 attorney for the defendants in this case, Cover Area
 15 School District and the school board, and I'm here
 16 today, as you know, to take your deposition in this
 17 manner. As I see it, to learn the basis for the expert
 18 opinion, which you provided in this case.
 19 There are few features of this process that are
 20 somewhat unusual. The first is that the questions and
 21 answers, they're verbal, but we have to make sure that
 22 we wait until -- that all responses are verbal, first of
 23 all. And second, that we wait until each other is done
 24 speaking before we talk so that Ana can get a good
 25 transcription.

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1 agreed off the record, that we can have 60 days to read
 2 and sign rather than the usually 30?
 3 MR. GILLEN: Yes.
 4 MR. ROTHSCHILD: Thank you.
 5 MR. GILLEN: No problem.
 6 BY MR. GILLEN:
 7 Q Would you please state your full name for the
 8 record.
 9 A My full name is Kevin Padian.
 10 Q Okay. Current address?
 11 A Home address?
 12 Q Yeah.
 13 A 425 Yale in Kensington, California 94708.
 14 Q How would you prefer that I address you for the
 15 purpose of the deposition?
 16 A First names are fine. It really doesn't
 17 matter.
 18 Q The same with me, please.
 19 A Okay.
 20 Q Have you been deposed before?
 21 A Yes. About maybe ten years ago in a different
 22 case.
 23 Q What case was that?
 24 A It had something to do with the Institute for
 25 Creation Research losing its accreditation in the State

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1 Another part of the process that tends to be
 2 highlighted here is that in precision of human
 3 communication, and I can assure you that after looking
 4 at the report, that there may be -- or there will be
 5 certain areas where I'm struggling just to understand
 6 that basis for your answer. Please bear with me if my
 7 questions are imprecise and tell me that you find them
 8 so, and I'll try to clarify them to the extent I can.
 9 By the same token, you know, if you -- if I struggle
 10 with your answer, please bear with me as I try and
 11 understand them.

12 We are somewhat late, and I regret that. It's
 13 not an endurance contest. If you need a break, please
 14 let me know. If there's any question I ask you that
 15 makes you uncomfortable or something that you don't feel
 16 that you'd like to talk about, please let me know, and
 17 I'll try to avoid that to the extent I can. I think
 18 that's about it for the general protocols.

19 Would you state your full name for the record.
 20 MR. ROTHSCHILD: I'm sorry, before we go on. I
 21 assume we're going to operate under normal stipulations,
 22 all objections, except as to form, are preserved to
 23 trial?

24 MR. GILLEN: I agree.

25 MR. ROTHSCHILD: And I've requested, and you've

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1 of California.
 2 Q Was it a state court proceeding, do you know?
 3 A I believe it was state court, yeah. Although
 4 it was so long ago, I don't remember the details.
 5 Q Okay. And you say about ten years ago?
 6 A Yeah. At least, yeah.
 7 Q And it was the Institute for Creation Research?
 8 A Creation Research, yeah, down in San Diego.
 9 And they were -- they were contesting it against Bill
 10 Honig, who was then State Superintendent of Education,
 11 Public Instruction.
 12 Q And for what purpose did you testify in that
 13 proceeding?
 14 A Whether the creation of science that they were
 15 teaching was, in fact, good science that should be
 16 taught in schools.
 17 Q Do you know the result of that proceeding?
 18 A I believe, I think they got their accreditation
 19 back, but I'm not sure. I don't remember the result
 20 anymore.
 21 Q And if you could describe for me, please,
 22 generally, the thrust of your testimony in that
 23 proceeding. Did you address, as you have here, the role
 24 of Paleontology?
 25 A It was so long ago, I can't remember all of the

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1 things that were asked. I don't remember that it took
2 very long, and I think it had to do with why creation
3 science wasn't science.

4 Q Were there other experts who testified in that
5 proceeding?

6 A I don't know. I don't remember.

7 Q Who retained you?

8 A I don't remember that either.

9 Q Okay. Do you know if perhaps the State
10 retained you?

11 A That might have been. And I'm trying to think
12 whether now it was an expert witness or whether they
13 just called me as a witness. I think maybe it was not
14 an expert witness.

15 Q Okay.

16 A I think in that case. So this would be then
17 the first.

18 Q But you answered my question honestly, which
19 is, had you testified in any other proceedings. Is that
20 the only one?

21 A Yes, I believe so. And that was just a
22 deposition, that didn't go to trial with me.

23 Q Now about, have you offered any expert opinions
24 via affidavit or declarations in other proceedings?

25 A Personally no, I don't think so.

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2 1 not involved with writing them. That's what the people
3 2 in the office do.

4 3 Q When you say the "day-to-day work is done by
5 4 the people in the office," who are you referring to?

6 5 A The executive director, Dr. Eugenie Scott, and
7 6 her staff.

8 7 Q Now, it's my understanding that you have
9 8 consulted with the plaintiffs in this case prior to
10 9 being retained as an expert?

11 10 MR. ROTHSCHILD: When you say "you," what are
12 11 you referring to?

13 12 THE WITNESS: The plaintiffs, I'm not sure.

14 13 Who -- if you're talking about the Dover parents, no, I
15 14 haven't.

16 15 BY MR. GILLEN:

17 16 Q No. And that's -- these are all fair
18 17 questions. Let me try and make my question more
19 18 precise.

20 19 Have you personally served as a consulting
21 20 expert with the plaintiffs in this action prior to the
22 21 filing of the lawsuit?

23 22 A No.

24 23 Q Do you know if anyone at the NCSC has served as
25 24 a consulting expert prior to the filing of the lawsuit?

26 25 A I don't know. You would have to ask when any

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1 00010

2 1 Q You say "personally," is there a particular
3 2 reason?

4 3 A Because I don't know if you would consider if
5 4 my -- if the nonprofit organization, of which I am
6 5 president, offers an amicus brief, which is not me, and
7 6 that's what I -- do you mean those things?

8 7 Q I appreciate your -- the forthrightness of
9 8 your answer. I was going to ask you about the next -- I
10 9 just want to get a sense for the declaration, sort of
11 10 something where either at the end of the -- at the
12 11 beginning of you're sworn or at the end, you say true
13 12 and correct to the best of my knowledge under penalty of
14 13 perjury.

15 14 A Yeah, I don't remember anything.

16 15 Q But I do know from your report and CV that you
17 16 are also the head of the NCSC, right?

18 17 A Yes.

19 18 Q And you mentioned an amicus brief that was
20 19 filed by the NCSC?

21 20 A They may have done so. I don't remember
22 21 specific cases on this, but -- I mean, if there are
23 22 such. And I should say that, yeah, I am the -- I'm the
24 23 president of NCSC. I'm the president of the board, but
25 24 the day-to-day work is done by the people in the office.
26 25 And so, I don't really decide about amicus briefs. I'm

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1 00012

2 1 of those people were contacted.

3 2 Q And when you say "any of those people," who are
4 3 you referring to?

5 4 A At the staff, whether its Genie Scott and her
6 5 staff people.

7 6 Q Okay.

8 7 A You'd have to ask them when they may have heard
9 8 of this or what contact they may have had.

10 9 Q If the NCSC staff had agreed to serve as a
11 10 consulting expert for the plaintiffs or their attorneys
12 11 in this case, who would make that decision?

13 12 A That would be Dr. Scott's decision.

14 13 Q Who else -- you mentioned her staff. Who else
15 14 works with Dr. Scott on a day-to-day basis at the NCSC?

16 15 A Gee, Glenn Branch is our deputy secretary.
17 16 Nick Natske, which is spelled N-a-t-s-k-e, I think, is
18 17 on the staff there. We have a couple of people who are
19 18 accountants and financial people. There is an
20 19 archivist, Susan Spath is another person who coordinates
21 20 research. I think Wes Zlsberry, which would be
22 21 E-l-s-b-e-r-r-y, is a researcher there. And Eric
23 22 Meikle, which is Eric M-e-i-k-l-e. And either people --
24 23 there may be other people who come and go, but they're
25 24 not they're with us for a while.

26 25 Q Of the names you mentioned, do you know if

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 2 1 anyone has served as a consultant to the plaintiffs or
 3 2 their lawyers in this case?
 4 3 A Before --
 5 4 Q Before the filing.
 6 5 A -- the onset of the filing of the lawsuit? I
 7 6 don't know particularly what their contacts may have --
 8 7 there contacts may have been. I'm not that involved in
 9 8 day-to-day work.
 10 9 Q Do you know if they had contacts prior to the
 11 10 filing of the lawsuit?
 12 11 A I believe they did because, usually, the way
 13 12 that NCSC becomes involved in something is that the
 14 13 organization is contacted by people who are concerned
 15 14 about the situation, who live there. And the -- the
 16 15 Dover affair has been going on, I guess, for a long time
 17 16 before the lawsuit was filed. So it's general public
 18 17 knowledge.
 19 18 Q Yes. Do you know any names from the Dover area
 20 19 that you're aware of?
 21 20 A No.
 22 21 Q Have you volunteered to provide this testimony
 23 22 or are you being compensated?
 24 23 A I'm not being compensated.
 25 24 Q Let me ask you, you've done an expert report in
 26 25 formulating that report, Kevin, what did you look over?

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 2 1 A I looked over most of the references cited in
 3 2 the back. I spent probably most of the time looking at
 4 3 the book Of Pandas and People. And many of the
 5 4 scientific references I already knew fairly well, and
 6 5 they're cited there for general support for the things
 7 6 I'm talking about.
 8 7 Q How about anything else, the pleadings or
 9 8 papers?
 10 9 A No.
 11 10 MR. ROTHSCHILD: Can you just -- objection --
 12 11 describe what you mean by that?
 13 12 BY MR. GILLEN:
 14 13 Q Sure. The complaint, the answer?
 15 14 A I received copies of those. So I was generally
 16 15 familiar with what was going on that led to the
 17 16 complaint.
 18 17 Q Did you review that in connection with
 19 18 preparing your expert report?
 20 19 A I looked over it. The focus of my report, I
 21 20 think, is trying to analyze the role of Paleontology
 22 21 vis--vis science in general. And on the other hand,
 23 22 Intelligent Design Creationism as an alternative to
 24 23 science.
 25 24 Q Yes. I mean, I agree. That's what I get out
 26 25 of it also.

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 2 1 Now about, did you review the answer that was
 3 2 filed in this case in connection with preparing your
 4 3 expert report?
 5 4 A I looked it over.
 6 5 Q Anything else?
 7 6 A I just had the complaint and the response.
 8 7 Q Okay. Apart from plaintiff's counsel,
 9 8 Mr. Rothschild, and anyone else on the plaintiffs' side,
 10 9 have you spoken with any other persons in connection
 11 10 with formulating your opinion? Let me --
 12 11 A When you say "other persons," do you mean other
 13 12 legal counsel?
 14 13 Q No. Other people at Dover Area High School,
 15 14 for example.
 16 15 A Oh, no.
 17 16 Q Haven't spoken with the Biology teachers there?
 18 17 A No, I haven't.
 19 18 Q How about other people at the NCSC?
 20 19 A Yes, I have.
 21 20 Q Who have you spoken with there?
 22 21 A I have spoken with Dr. Eugenie Scott and with
 23 22 Wick Matske. And also, briefly, with Glenn Branch.
 24 23 Q Did they provide you with any factual basis for
 25 24 your report?
 26 25 A I don't recall that they provided any factual

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 2 1 basis because they are not Paleontologists, and I am.
 3 2 But I did want them to see whether this -- whether what
 4 3 I was saying made sense to a reasonable person who was
 5 4 not a Paleontologist.
 6 5 Q Okay. So if I try and just get a sense for how
 7 6 you have made an assessment of what's going on in Dover
 8 7 Area High School, what's the basis for your knowledge
 9 8 about the events at Dover Area High School?
 10 9 A The account that was -- that has been reported
 11 10 through various media, including the popular press, my
 12 11 understanding is that there was an attempt to introduce
 13 12 Intelligent Design Creationism into the Dover School
 14 13 curriculum as an alternative approach to evolutionarily
 15 14 biology. And that, to this end, the text Of Pandas and
 16 15 People was going to be recommended or used in class.
 17 16 Apparently, 50 copies of the book were at some
 18 17 point donated to the school library. There was a
 19 18 statement that was to be placed in the curriculum about
 20 19 the consideration of ideas, other than evolution, such
 21 20 as Intelligent Design. And that, eventually, a
 22 21 statement was read in the public schools by
 23 22 administrators, apparently because the teachers refused
 24 23 to read it, stating that -- that the idea of evolution
 25 24 had problems, and that there were other ideas, and that
 26 25 people should be open minded. And it was read to the

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 2 1 students by the administrators, and that was it.
 3 2 Q Is your opinion, your expert opinion, premised
 4 3 on that particular sort of factual basis or is it just
 5 4 one that's more generally directed to the role of
 6 5 Paleontology and addressing Intelligent Design Theory?
 7 6 MR. ROTHSCHILD: Objection. You can answer.
 8 7 THE WITNESS: Gee, those are two kind of
 9 8 different questions.
 10 9 BY MR. GILLEN:
 11 10 Q Yeah. All right.
 12 11 A I think they're both fair, but I'm not sure
 13 12 whether there were four questions.
 14 13 Q Okay. I can see that. Go ahead. Tell me why
 15 14 you see them as different and answer them to the extent
 16 15 you can. I'll try and clarify.
 17 16 A Is your first question whether I think
 18 17 Paleontology bears on the introduction of Intelligent
 19 18 Design into classroom?
 20 19 Q Well, I guess what I'm asking is, I've read
 21 20 your expert report. It has this detailed and
 22 21 sophisticated analysis of the way Paleontology speaks to
 23 22 some claims that are made by proponents of Intelligent
 24 23 Design Theory, that's what they call it. I understand
 25 24 that you quote 'Intelligent Design Creationism.' That's
 26 25 one -- that's certainly the main thrust of your opinion

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 2 1 do. And I've served several times on the evaluation of
 3 2 instructional materials, textbooks and things like that
 4 3 for K-12. And I do a lot of textbook reviewing, as
 5 4 well, for, you know, just people just ask me how does
 6 5 this sound.
 7 6 So as an educator, I'm functioning also as a
 8 7 scientist. So the question that I'm really addressing
 9 8 is, would this be good science and would this be good
 10 9 science education.
 11 10 Q That's exactly what I was trying to get a sense
 12 11 for, just at the outset.
 13 12 When I look at your credentials and report,
 14 13 it's evident you're highly credentialed in paleontology.
 15 14 I wanted to ask you, just in terms of your training,
 16 15 have you had instruction in molecular biology?
 17 16 A Any instruction that I had in molecular
 18 17 biology, formal instruction, would have ended with my
 19 18 doctoral dissertation in the 1970s. And molecular
 20 19 biology changes so fast, that I can keep up with it with
 21 20 departmental seminars and reading. Just like everything
 22 21 else, you know, your formal instruction ends at some
 23 22 point, and then you pretty much have to keep up with
 24 23 things as best you can.
 25 24 Q Would you consider yourself an expert in
 26 25 molecular biology?

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 2 1 insofar as I, as a layman, can make it out.
 3 2 Then there's a series of other issues in this
 4 3 case that relate to, you know, sort of the practical
 5 4 result of the process, what actually happened. And I'm
 6 5 trying to get a sense for your expert opinion and what
 7 6 it's primarily concerned with. It seems to me, it's
 8 7 primarily concerned with the former. That is, sort of
 9 8 the intellectual discussion about the way in which
 10 9 Paleontology relates to the claims of evolutionarily
 11 10 biology, but not so much to the actual situation in the
 12 11 schools. Is that accurate?
 13 12 MR. ROTHSCHILD: Object to the
 14 13 characterization. Particularly to the extent it's
 15 14 inconsistent with the content of the expert report.
 16 15 You can answer.
 17 16 THE WITNESS: I would say that I'm working at
 18 17 two levels in this report. First, as a scientist, and
 19 18 second, as an educator. I've taught at Berkeley for 25
 20 19 years. Before that, I've taught high school, sixth
 21 20 grade, seventh grade science. I -- so I suppose I've
 22 21 been teaching since -- well, well over 30 years. And
 23 22 I've worked a lot with teachers in this state on science
 24 23 education, and what the quality of that education should
 25 24 be. I was involved, as you know, with writing this 1990
 26 25 state science framework, which took really two years to

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1 00020
 2 1 A No.
 3 2 Q Now about the same thing, its -- from your
 4 3 report, it's evident there's some aspects of statistics
 5 4 probability theory. What training do you have in that?
 6 5 A I'm not an expert.
 7 6 Q You mentioned that California standards for K
 8 7 through 12. Are there standards that speak to
 9 8 instruction in biology?
 10 9 A Could I distinguish between the standards and
 11 10 the framework those are two different -- there's -- the
 12 11 names are so confusing.
 13 12 Q Okay.
 14 13 A The framework is put together about every seven
 15 14 years. And it's a book length document that explains
 16 15 what science is, how it should be taught. It explains
 17 16 the concepts that should be laid out at all the grade
 18 17 levels, and tries to explain how they should be
 19 18 interwoven into a general picture of science.
 20 19 The State's standards are -- that's a different
 21 20 document. And those tend to be more specific in terms
 22 21 of what sorts of concepts are discussed and their
 23 22 details.
 24 23 Q Okay. If I can, I'm just going to mark a copy
 25 24 of your report as Exhibit 1.
 26 25 (Defendant's Exhibit 1 was

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2 1 marked for identification.

3 2 BY MR. GILLEN:

4 3 Q Kevin, I'm going to show you a copy of

5 4 something that's been marked as Exhibit 1, and ask you

6 5 to look it over. I think you'll see it's another copy

7 6 of your report, which I'm just marking for the purpose

8 7 of reference in this deposition. It begins with the

9 8 cover page, which is page 1, and you've mentioned the

10 9 California Science Framework, K through 12. Is that the

11 10 project that you were just describing?

12 11 A Yes.

13 12 Q I just want to get a sense for the difference

14 13 between that framework and the standards, and how each

15 14 speaks to the dispute that brings us here, which is this

16 15 teaching of evolutionarily theory and biology. Can you

17 16 give me just a short, if you will, overview of the way

18 17 in which the California Science Framework speaks to

19 18 instruction in evolutionarily biology, and particularly,

20 19 whether it prohibits the teaching of Intelligent Design

21 20 Theory?

22 21 A The framework that I worked on was the one that

23 22 came out in 1990.

24 23 Q Okay.

25 24 A Intelligent Design was not on the map then. It

26 25 did not specifically address Intelligent Design.

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1 00022

2 1 Q Has it been -- has a new addition of the

3 2 Science Framework been --

4 3 A Yes. It was released a couple of years ago

5 4 because these are done every seven years.

6 5 Q Did you play a part in that process?

7 6 A No.

8 7 Q Are you aware of whether that specifically

9 8 addresses instruction in the Intelligent Design Theory

10 9 or --

11 10 A I'm not -- I'm not aware that it does.

12 11 MR. ROTHCHILD: Can I have a standing

13 12 objection to the term "Intelligent Design Theory"? I

14 13 think it's one that the witness probably wouldn't agree

15 14 with, but I'm not going to quarrel with you using the

16 15 term, is my standing objection.

17 16 MR. GILLEN: Certainly. Certainly, I do

18 17 understand that.

19 18 BY MR. GILLEN:

20 19 Q When this was authored, Kevin, there was

21 20 creationism in the air and some disputes relating to the

22 21 teaching of creationism in connection with

23 22 evolutionarily theory. Did your Science Framework

24 23 address that issue or the issues that surround the --

25 24 this clash between evolutionarily theory and

26 25 creationism?

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1 00023

2 1 A I don't believe it did directly, Pat. The --

3 2 we tried to focus on what was good science and good

4 3 science education. Not on what was non-science,

5 4 anti-science or poor science. We tried to -- we

6 5 devised, with the board of education, a statement that

7 6 appeared that was very prominent. In fact, we drafted

8 7 this before the framework was even written. We agreed

9 8 with the board to submit a statement that explained that

10 9 nothing in science, or any other field, had to be

11 10 believed or accepted in order to be taught. To be

12 11 educated, you had to be aware of things. But it didn't

13 12 require belief in anything. And that, we hoped, would

14 13 defuse some of the controversy that people felt about if

15 14 I teach this in science, am I contradicting personal

16 15 beliefs about things. And our statement is simply,

17 16 well, you know, education doesn't compel belief, only

18 17 understanding.

19 18 Q Let me make sure I understand you. Was the

20 19 statement designed to address concerns brought to you or

21 20 others involved in the part by teachers about teaching

22 21 evolutionarily theory and the way it was received?

23 22 A That's part of it, but also, we knew very well

24 23 of anti-evolution activities in the State, including

25 24 creation science. People who simply didn't want

26 25 evolution taught for various reasons. Largely because

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2 1 they felt it was against their religious beliefs.

3 2 In the State of California, you were not

4 3 allowed to opt out of a class because you don't agree

5 4 with what's going on. In fact, I believe in science

6 5 classes, it was, and may still be, the rule that you

7 6 don't have to be present for a dissection. I think

8 7 that's the only thing you can be excused from.

9 8 Q So there is an opt-out with respect to the

10 9 classes that instruct in biology?

11 10 A No, there's not.

12 11 Q There's not?

13 12 A Only -- I think dissection is the only

14 13 exception. You can't not attend a class simply because

15 14 you know it's going to be on something you disagree

16 15 with, or you think you disagree with.

17 16 Q Okay. I'm not understanding you. Is there an

18 17 exception for this instruction, this subject?

19 18 A No.

20 19 Q Okay. Okay.

21 20 A In other words, if you objected to a class that

22 21 was going to be given on green house or earth warming,

23 22 something like that, you couldn't absent yourself from

24 23 class on the grounds that you didn't agree with what was

25 24 going to be said.

26 25 Q Okay.

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2 1 A And we wanted to -- we wanted to put in the

3 2 framework what was good, accepted science, that is

4 3 science accepted by the scientific community so that

5 4 teachers would be able to point to it and say, look,

6 5 this is what I'm supposed to teach. You know, I may not

7 6 agree you with, you may not agree with it, but this is

8 7 what's accepted by the scientific community and the

9 8 community of science educators. So there would be

10 9 support, clarity, consistency.

11 10 Q Okay. So the statement was designed to help

12 11 public education teachers deal with this culture?

13 12 A That's right.

14 13 Q Let me ask you about the standards. The

15 14 standards that are currently enforced now, are you aware

16 15 of whether they speak to the teaching of Intelligent

17 16 Design Theory in class?

18 17 A I don't remember if they do, specifically. I

19 18 did not play a strong role in the drafting of the

20 19 standards. And my impression is that they don't, but I

21 20 haven't looked at them specifically with that in mind.

22 21 Q What do the standards do, if you can tell me,

23 22 do they layout specific objectives for each course of

24 23 instruction?

25 24 A Yes, they tend to do that.

26 25 Q Do they do anything else? Do they give course

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2 1 objectives?

3 2 A They might do. I haven't looked at the final

4 3 document.

5 4 Q Okay.

6 5 A Well enough to tell you whether that would be a

7 6 good characterization of it.

8 7 Q Okay.

9 8 A In all, perhaps the sum total of the curriculum

10 9 that they provide does, in fact, do that by virtue of

11 10 what it says.

12 11 Q They're a public document?

13 12 A Yes. It would be on the web. And, you know, I

14 13 don't have a paper copy of it. I just tend not to sit

15 14 in front of a screen all day.

16 15 Q That's quite all right. I'm just trying to

17 16 figure out how they relate in light of your earlier

18 17 comment. That's all I want to see if they bear on some

19 18 of the issues in this case.

20 19 When you're -- for the California Science

21 20 framework, when you employ the term "teaching," is there

22 21 any specific meaning you give that term?

23 22 A Teaching in the sense of explaining what is in

24 23 the curriculum, I suppose, would be the best. But, my

25 24 gosh, there's so much more to teaching. It's

26 25 understanding what students come in with, understanding

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2 1 how, as a group, and how individuals, they will best

3 2 learn or respond to what you're trying to teach them.

4 3 Trying to work with the prior knowledge of 30 different

5 4 kids in class and their own behavioral and hormonal, and

6 5 just personality differences. Teaching is so much more

7 6 than just explaining material.

8 7 Q Yeah. Plainly, it's an art.

9 8 What I'm to trying to get at, though, is there

10 9 a specific sort of pedagogical meaning that's attached

11 10 to it like classroom instruction?

12 11 A Well, most teaching at the K-12 level, and at

13 12 the college level, is based on classroom instruction.

14 13 The 45 minutes a day or the three hours a week, you have

15 14 students in front of you, but teaching also occurs in

16 15 office hours. With my graduate students, it's 24/7.

17 16 Every time -- all the time we're in there, we're all

18 17 teaching and learning from each other.

19 18 Q Okay.

20 19 A It gets very fluid in the upper grades.

21 20 Q All right. Let me -- I'm just going to -- if

22 21 you'll look at your report, I'm trying to understand

23 22 what -- some of the details. And that's not so easy for

24 23 me as a lay person, particularly one not schooled in

25 24 science.

26 25 The section B is headed paleontology as

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2 1 Science. And plainly, status of science is important to

3 2 this case. I know very well that you have devoted your

4 3 considerable talents to paleontology. And what I want

5 4 to get a sense for is, plainly, you regard it as

6 5 science. What makes you regard what you do, as a

7 6 professional, as distinctively a scientific endeavor?

8 7 A We collect information, facts about the life of

9 8 the past. That is sort of the purview of paleontology.

10 9 That life includes zoology, botany, any other subjects

11 10 that happen to focus on things that are now dead and

12 11 have been for a while. And our subject is that great

13 12 phone book of life that's existed in the past for which

14 13 we have some remains that are -- that are excavated from

15 14 rock deposits in the earth. And these specimens tell us

16 15 about the life of the past, how it changed through time,

17 16 how it is ordered through time. The different organisms

18 17 that lived at various intervals in time. How they

19 18 functioned in their environments. What the patterns

20 19 were by which different groups in the past waxed and

21 20 waned, ultimately coming to form the bio that we have

22 21 today.

23 22 Q And I understand that. I can see that you're

24 23 looking at sort of an empirical set of data facts, and

25 24 you're bringing to bear principles of certain

26 25 disciplines you mentioned, zoology and so on. But what

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 2 1 I'm -- you know, for me, as someone on the outside, I'm
 3 2 trying to understand the distinctive features of
 4 3 paleontology that you believe make it scientific.
 5 4 MR. ROTHSCHILD: Objection to the form. You
 6 5 can answer.
 7 6 THE WITNESS: The distinctive features of
 8 7 paleontology. Gee, they really don't defer from many
 9 8 other scientific fields like zoology, botany, insofar as
 10 9 they concentrate on a subject. In ornithology, it's
 11 10 birds. Of course, in botany, it's plants. In
 12 11 paleontology, it's -- can be both birds and plants, but
 13 12 it's just extinct ones.
 14 13 And so our approach is to gather information
 15 14 and to form and test hypotheses about how these
 16 15 organisms lived in the past and how that changed through
 17 16 time.
 18 17 Q And I think that last part of your answer helps
 19 18 we get further towards what I'm trying to grasp, which
 20 19 is, you say, "to form and test hypotheses." If we look
 21 20 at the methods of paleontology, are there certain
 22 21 methods that you believe make it distinctively
 23 22 scientific?
 24 23 MR. ROTHSCHILD: Objection.
 25 24 THE WITNESS: It depends on what question
 26 25 you're asking. Paleontology is, of course, more than

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 2 1 group of extinct animals that I work on, dinosaurs,
 3 2 horses, whatever it might be, I would use methods such
 4 3 as phylogenetic systematics, p-h-y-l-o-g-e-n-e-t-i-c,
 5 4 systematics is s-y-s-t-e-m-a-t-i-c-s.
 6 5 Q Nothing like an educated witness.
 7 6 That said, what else? What other tools would
 8 7 you use, Kevin?
 9 8 A If I were trying to study the functional
 10 9 morphology of an extinct animal, I would use the same
 11 10 principles of comparative anatomy and motion studies,
 12 11 for want of a better word, we call them kinematics,
 13 12 k-i-n-e-m-a-t-i-c-s, that are used by zoologists. The
 14 13 difference being that they can put their animals on
 15 14 treadmills, and they can take films of them doing what
 16 15 they do. And we basically have to work with the joints
 17 16 of the bones that are left.
 18 17 Q Okay. And that is some examples. I was struck
 19 18 by this part of your -- this Section B of your report,
 20 19 which said: To ask intelligent questions and determine
 21 20 reasonable answers requires knowledge of fossils of
 22 21 comparative anatomy of geology systematics, and so on.
 23 22 And then as I read the report, I noticed that there's --
 24 23 in several places, you say, you offer sort of reasonable
 25 24 inferences in a number of areas.
 26 25 And that, Kevin, is what I'm trying to drive

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 2 1 just going out to the Badlands, finding a skull of a
 3 2 dinosaur, digging it up, and bringing it back. In that
 4 3 respect, it probably differs from botany, zoology,
 5 4 molecular biology, in that work might be done in the
 6 5 forests and the fields or the labs, more so than in
 7 6 going out to the rocks and looking for things.
 8 7 That's not a question of the method of science
 9 8 or it's approach. That's simply a question of its
 10 9 material basis. It's where we find it. The molecules
 11 10 we can best get at in the lab. The plants and animals we
 12 11 can best go out to the field and collect them or see
 13 12 them or watch them. And in our case, we go out to the
 14 13 exposed rock terrains and we collect them. But it
 15 14 really depends on the kinds of questions that you're
 16 15 asking. If I'm asking questions about what are the
 17 16 relationships of fossil animals, I'm using the same
 18 17 principles that a botanist or a zoologist would use, and
 19 18 the same methods. It's just that our organisms are
 20 19 different.
 21 20 BY MR. GILLEN:
 22 21 Q Okay. And that's precisely what I'm trying to
 23 22 understand, which is what are -- in a case like that,
 24 23 which you posited, what are the methods that you're
 25 24 using which are similar to those of a botanist?
 26 25 A If I were trying to find the relationships of a

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1 00032
 2 1 at. Does your endeavor, as a paleontologist, consist in
 3 2 just trying to do that, trying to make reasonable
 4 3 hypotheses and evaluate them against the empirical
 5 4 evidence that's available?
 6 5 MR. ROTHSCHILD: Objection to the form. You
 7 6 can answer.
 8 7 THE WITNESS: I would guess that's a lot of it.
 9 8 We form and test hypotheses about the relationships of
 10 9 organisms, about how they worked in their environments.
 11 10 We describe the life of the past, new things that we
 12 11 find. We look at where we lived and how they may have
 13 12 spread over various continents and oceans through time.
 14 13 We're basically reconstructing the life of the past by
 15 14 accumulating data, discerning patterns and trying to
 16 15 infer processes that account for the change of life
 17 16 through time.
 18 17 BY MR. GILLEN:
 19 18 Q And let me just -- I'm going to ask you a few
 20 19 things quickly and see if you can help me. I'm just
 21 20 trying to get a handle on the way in which your
 22 21 discipline works.
 23 22 On page 1 of your report, you pose a question,
 24 23 what are the relationships among groups of fossil
 25 24 organisms. In your day-to-day work as a paleontologist,
 26 25 how do you go about trying to answer that question?

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2 1 A We look at the preserved features of the

3 2 organisms. In the case of things I work on, it would be

4 3 features of the skulls and other bones of the skeleton,

5 4 which are usually mostly what's left in the fossil?

6 5 records. And by looking at those features, we find what

7 6 systematics calls synapomorphies, which is a word that's

8 7 spelled s-y-n-a-p-o-m-o-r-p-h-i-e-s. It's a funny word,

9 8 and it means shared derived characters. These are

10 9 features that are unusual compared to other animals or

11 10 plants. They are things that are novelties compared to

12 11 other animals and plants. And why we look for these

13 12 features follows simply from a premise about genetics.

14 13 And that is, that organisms inherit characteristics

15 14 from their parents, and they pass them on. And so when

16 15 a new feature appears in a lineage, and it's passed on

17 16 to its descendants, then we use that new feature as a

18 17 mark of more recent common ancestry than with other

19 18 organisms that don't have that feature.

20 19 It's a little confusing, but it actually

21 20 results in a very interesting hierarchical pattern. If

22 21 you have, for example, five organisms that you're

23 22 comparing, and two of them share six features that

24 23 nobody has, and the next one added to them -- shares

25 24 five of those features, and the next one out shares four

26 25 of them, the next one out shares three of them, and so

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2 1 on, ultimately, you're watching the sequence of these

3 2 new shared derived characters that appear. So you have

4 3 actually a hierarchical arrangement of the order in

5 4 which these things would be related to each other. Does

6 5 that make sense?

7 6 Q Yeah. It does somewhat. I mean, it's

8 7 difficult to follow, but that's what I'm trying to get

9 8 at. Is there any other way in which you go about

10 9 finding those relationships?

11 10 A No, that's --

12 11 Q The principle --

13 12 A -- that's the principle of phylogenetic

14 13 systematics.

15 14 Q Okay. Again, in your report, you ask the

16 15 question, how do mechanisms of developmental biology

17 16 help us to explain morphological diversification of

18 17 structures in plant and animal evolution.

19 18 Now, when you look at that question, Kevin,

20 19 what is the method or the method you bring to bear on

21 20 that question?

22 21 A We often look at how structures in living

23 22 organisms develop. We can -- we can have a much better

24 23 idea of the development of living animals than of fossil

25 24 animals because embryology of fossil animals is

26 25 difficult to come by, particularly early stages. They

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2 1 don't preserve very well. And so, when we ask questions

3 2 about, for example, which digits are these three digits

4 3 of the bird's hand, or where did the bones in the middle

5 4 ear of mammals come from. Sometimes by looking at the

6 5 development of living animals, we can see whether

7 6 fingers are lost or begin to form and then stop forming

8 7 or how bones migrate from an area around the jaw into

9 8 the ear. And that gives us some clue about whether that

10 9 could have been the process that evolutionarily caused

11 10 that change to happen.

12 11 Q Anything else you used to try and make that --

13 12 answer that question?

14 13 A There are some sophisticated new techniques in

15 14 developmental genetics that actually trace the

16 15 expression of a gene in different structures, which then

17 16 can be labeled and seem to be the same in two different

18 17 organisms, even though they may appear to do different

19 18 things, or their form is somewhat different.

20 19 Q Is that something that Paleontologist use?

21 20 A Paleontologists do use it. Some of them even

22 21 work in developmental genetics and do this work. Many

23 22 developmental geneticists also work with Paleontologists

24 23 to try to solve some of these problems. One of my

25 24 graduate students right now, for instance, is looking at

26 25 the formation of something called the neural crest.

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2 1 Neural is n-e-u-r-a-l. Crest, which is a tissue that

3 2 forms early in life and it's responsible for forming

4 3 many of the tissues in the body. And she's working on

5 4 whether the turtle shell and the bones that are in the

6 5 back of crocodiles, the kind of hard armor that

7 6 crocodiles have along their backs, is actually produced

8 7 by the neural crest. And to do that, she has to work in

9 8 developmental genetics.

10 9 So, yes, I guess, I would have to say that

11 10 Paleontologists are increasingly working in these and

12 11 other disciplines.

13 12 Q You mentioned the mechanisms of developmental

14 13 biology. When you use that term, what are you referring

15 14 to?

16 15 A I'm referring to the general field that

17 16 examines how specific genes influence functions of the

18 17 development of structures that later become part of the

19 18 adult body.

20 19 Q So I'm not sure, is that genetics? Are you

21 20 saying it's essentially the focus on genetic change?

22 21 A Yeah. It is how genetic change influences the

23 22 formation of the structures.

24 23 Q Okay.

25 24 A In other words, morphology.

26 25 Q That's what I was trying to get at.

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 2 1 When you -- do you have an opinion, as a
 3 2 Paleontologist, as to what that sort of that mechanism
 4 3 of developmental biology is that produces the genetic
 5 4 change?
 6 5 A Do I have an opinion as a Paleontologist of
 7 6 what that is? It's -- we understand it as gene
 8 7 function.
 9 8 Q Okay.
 10 9 A But I guess maybe I don't understand the
 11 10 question.
 12 11 Q When you reference the mechanism of biological
 13 12 change, I just want to make sure that I -- I'm looking
 14 13 at that term the way you do. And that's all I'm trying
 15 14 to understand. Is it essentially, as you say, the
 16 15 biological disciplines understanding of genetic change
 17 16 through time?
 18 17 A Yes. It's completely consistent with that, as
 19 18 far as we know. We know that genes vary in populations.
 20 19 We know that in lineages and related species, there are
 21 20 different genetic constitutions. And this discipline
 22 21 focuses mainly on how specific genes determine specific
 23 22 functions that then influence these changes in form.
 24 23 I'm sorry. I'm trying to speak as -- to
 25 24 explain it. I'm trying not to over simplify it, but to
 26 25 use words I hope --

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 2 1 Q That's all I'm trying to do to. I appreciate
 3 2 any effort on your part to simplify what you do
 4 3 day-to-day. That's totally appreciated.
 5 4 What I'm trying to get at here is my sense that
 6 5 when you refer to the mechanisms of biological change,
 7 6 you are -- sort of, your discipline, which strikes me as
 8 7 profoundly sort of interdisciplinary, is borrowing in
 9 8 that area from the biological sciences. And when you
 10 9 reference, therefore, the mechanism of biological
 11 10 change, you are referring to genetic change through
 12 11 genetic mutation, and then heredity. Is that accurate,
 13 12 Kevin?
 14 13 A Yes. That's -- and you're absolutely right.
 15 14 We have a very interdisciplinary science.
 16 15 Q And that's -- and then my next question then is
 17 16 to try and get a sense for the several places in your
 18 17 report where you have this -- you're taking issue with
 19 18 the notion of randomness. And on the one -- I'm trying
 20 19 to understand that. And let me see if I can tell you
 21 20 what I think, and then we can talk about it.
 22 21 It seems to me that, from what you said, that
 23 22 genetic change is random, random mutations, but when you
 24 23 get to selection, it seems that you have a very definite
 25 24 conviction, as a Paleontologist and a scientist, that
 26 25 that selection is not random. I want to see if I'm

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 2 1 apprehending your position correctly and then just have
 3 2 you explain it to me a little more. Is that accurate,
 4 3 Kevin?
 5 4 A I'm sorry, no.
 6 5 Q Okay. Tell me why.
 7 6 A Selection is the opposite of random.
 8 7 Q And I do understand that.
 9 8 A Okay. So that if we had random admission to
 10 9 university, it would be very different then if we
 11 10 selected people on the basis of various features that --
 12 11 and --
 13 12 Q But -- excuse me, because I don't want to waste
 14 13 your time, or anyone's time here. We have the genetic
 15 14 changes, right?
 16 15 A Yes.
 17 16 Q And then it seems that, based on your report,
 18 17 if I'm understanding it, then there's a selection
 19 18 process. I'm just focusing right now on that genetic
 20 19 change. And I'm -- it seems to me, based on your
 21 20 report, that when you're describing that facet of the
 22 21 mechanism of biological change, that is random, is that
 23 22 correct?
 24 23 A Let me explain it slightly differently. When
 25 24 we say something is random, it's a probabilistic
 26 25 statement about -- about the distribution of certain

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 2 1 cases in a population. It does not mean that the causes
 3 2 are random. We may understand very well what the causes
 4 3 are of some kind of a change. We may still not know
 5 4 which individuals in a population would be affected in
 6 5 advance of this actually happening.
 7 6 I believe I used an analogy to -- I'm not sure
 8 7 if I did in this report. I'm sorry, Pat. Let me give
 9 8 you an analogy. We may say that 353 house fires occur
 10 9 in California each year. If -- and we know why they're
 11 10 caused, arson, smoking in bed, lava lamps fall over,
 12 11 whatever. We have a good idea that maybe that pattern
 13 12 has been 350, roughly, for a long time, where it's a
 14 13 rate of 350 in the population, you know, maybe grows
 15 14 with the populational rate, that's fine. But we don't
 16 15 know in advance which houses are going to burn. If we
 17 16 did, we wouldn't need insurance. And when we talk about
 18 17 random effectively, we could say, well, house fires --
 19 18 or the instance of house fires is random, but it's not
 20 19 in that case because we know that they each have a
 21 20 cause. They just don't happen. It's just that we can't
 22 21 predict which ones will be there in advance.
 23 22 Now, let's say we have a simple genetic
 24 23 mutation of white-eye in a fruit fly or something.
 25 24 Just -- not very important thing, just a little -- and
 26 25 that on the average, say be about six in 100,000 might

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1 have this white-eye difference. We might or might not, and I don't know fly genetics enough to tell you, we might or might not know the gene function that produces that white-eye. We may know which gene does it, even if we don't know what the function is. But we know that that change itself is not random. We simply know that the -- which particular individuals in the population will have it, is random. And if we have a rate of six in 100,000, we may have eight one year and three the next generation. But that's the meaning of random to a scientist, as I understand it.

Q And I understand that, and thank you. I'm just trying to get a sense for -- let's keep with the fruit fly. The first instance of the gene that produced the white-eye. If we look at the mechanism for that change, is that random mutation or do have some other understanding of how the biological sciences address that initial mutation that produces a change in a given species, in this case, the white-eye in the fruit fly?

A It's a change, but I don't think it would be correctly characterized as random. We know that a duck's head isn't going to pop up on a horse or a trout. So in a sense of anything can happen, that's not our understanding of random. And when, you know, your kids come in and say, oh, like that's so random. They

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Q Okay. So then when you look at -- you say -- when you say natural selection is the opposite of randomness, explain then, what, to me, please, so I can understand you, what are you getting at there, what is -- why is natural selection not random, in your opinion?

A If you have a population of organisms, they might be -- they might be nice, let's say, living out in the field somewhere. Darwin's idea was that some organisms, some individuals, would be more fit than other individuals. And that the ones who would be better able to live in their environments escape from predators and so forth, make more efficient use of food resources, and so forth, would be the ones more likely to survive to the next generation. And to survive perhaps longer to produce more offspring so that those same features that this organism had would be passed on to the next generation. That's his idea of selection.

Random would be those same mice living in a field and a tree falls and kills 50 of them. And the 50 that it kills are -- have no real fitness component about them. In other words, it's taking everybody regardless.

When the plane crashes, it doesn't matter whether you're a -- you know, the Pope or the president

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don't -- they're talking about it like it came from nowhere. Somebody just seemed to say something that was a non sequitur. And so our common understanding of words like random are real different from what we mean in science. And my understanding of random, as a scientist, would not apply to causal factors, but rather to distributional factors in populations.

Q Okay.

A For example.

Q Okay. Then just let me understand here if I can. Are you saying that there's no such thing as a random genetic mutation?

A When applied to causality, I would say I don't understand how the word "random" is interesting or applicable there.

Q And by that --

A Although we talk about it all the time, don't we? And what I think we mean is the incidents in populations.

Q So again, just to make sure I understand you, is it your view that any genetic change is not random?

A I would agree with you in the sense that it is all determined by biochemical causes, genetic causes, things that get down to the genetics -- that determines structure.

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or, you know, just some normal dumb guy like me. It just -- that's what happens when you happen to be on that plane when this happens. So that would be non-selective. That would be sort of a random culling of the population in that sense, because it wouldn't be correlated with any selective factors that have to do with the organisms themselves. Rather, they were unlucky.

Q So am I understanding you correctly that, essentially, you believe natural selection is not random because it's positing a causal connection between the attributes of the given species and its ability to survive?

A Just so.

Q Now, but that just -- and in positing that relationship, you're -- it entails positing both an advantage or feature of a species and then a way in which it would confer an advantage on the members of that species with that characteristic; is that true?

A That's the idea.

Q Okay. And is that why, Kevin, in your report at several points, you make this very clear, selection is the opposite of random. Is that what you're getting at there?

A Yes.

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2 1 Q Just so I can understand it, it's a notion that
3 2 there's a causal connection between the feature and
4 3 survivability as opposed to, as you say, the tree falls.
5 4 It had nothing to do with who or what you were and what
6 5 your attributes were, it's just bad luck?

7 5 A That would be the idea.

8 7 MR. ROTHSCHILD: This is a good time for a
9 8 break?

10 9 MR. GILLEN: Yeah, it is.

11 10 (Recess.)

12 11 BY MR. GILLEN:

13 12 Q Kevin, this is -- all the questions I've asked
14 13 you so far, I'm trying to just make sure I understand
15 14 this process as you do, which -- just in its rudiment.
16 15 What I'm looking at is the statement like this at the
17 16 bottom of page 2 of your report that carries over.
18 17 You're talking about Darwin's view, and you say, he was
19 18 not talking about how major new adaptive changes took
20 19 place; he was talking about how minor variations could
21 20 be selected upon by natural forces to produce heritable
22 21 evolutionarily change.

23 22 And there's a couple of elements to that
24 23 sentence that have to be impacted to a layman like
25 24 myself. The first is the minor variations in the
26 25 species. Am I correct in that when you, as a

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2 1 of the species and the environment which confers an
3 2 evolutionarily advantage on the species with a specific
4 3 trait; is that accurate?

5 4 A Yes, more or less. Some individuals are going
6 5 to be more favored than others.

7 6 Q All right. And then produce heritable
8 7 evolutionarily change. Just to make sure I understand
9 8 what you're getting at there. It's that notion
10 9 therefore, because of these -- this advantage, it's more
11 10 likely that species with the advantage or members of the
12 11 species with the advantage will pass it on in the
13 12 genetic matter of their offspring?

14 13 A That was Darwin's idea.

15 14 Q Okay. Now, then you say, when you go on, you
16 15 say his main concern, Darwin said this, was with the
17 16 mechanism of natural selection, which cannot be observed
18 17 directly in the fossil record. Now, I wanted to make
19 18 sure I understand that. Again, the mechanism of natural
20 19 selection. Is this the relationship between the feature
21 20 and the environment or is it the genetics or a
22 21 biological component of the process?

23 22 A It's the process by which the composition of a
24 23 population changes from one generation to the next based
25 24 on factors that make it more fit for its environment.
26 25 That would be selection in that sense.

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3 1 Paleontologist, look to those minor variations in the
4 2 species, you account for them with reference to biology,
5 3 more specifically genetics?

6 4 A When we see variation in a population of
7 5 organisms, whether its living or fossil, there are two
8 6 basic causes of that variation. One is genetic, and one
9 7 is environmental.

10 8 Q Okay.

11 9 A So a stunted population of trees might be
12 10 stunted not because their genes make them short, but
13 11 because their environment is harsh and it's tough to
14 12 grow.

15 13 Q Okay. And if -- so of those two possibilities
16 14 for the minor variations, we have one that's genetics or
17 15 internal, and then there's another that's external to
18 16 the subject, the specimens; is that accurate?

19 17 A Yes. One is heritable, and the other one
20 18 isn't.

21 19 Q Okay. And for the purposes of -- well,
22 20 Darwin's theory, we're looking at the heritable?

23 21 A Yes.

24 22 Q Now, selected upon by natural forces. I think
25 23 you gave me some good examples of that earlier. That's
26 24 in ways in which the surrounding environmental factors
27 25 give rise to a causal relationship between the features

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2 1 And when I say that we can't observe this in
3 2 the fossil record, what I mean is that we can't observe
4 3 generation-by-generation full populations, we can't take
5 4 their genetic constitution. We don't have a complete
6 5 enough sample. So when we look at the action of
7 6 selection itself on a generation-by-generation basis,
8 7 that's much better than done in field and laboratory
9 8 studies today. And a lot of that work has been done.

10 9 Q That's what I was trying to understand. You're
11 10 getting at there that the fossil record, as it exists
12 11 today, is insufficient to wholly grasp this process
13 12 you've described. Is that your point?

14 13 A It's insufficient to measure the
15 14 generation-by-generation selective factors. What it
16 15 does measure, is the overall effect of selection on
17 16 populations through time, which -- one of which we call
18 17 adaptation. And so, we actually identify the action of
19 18 natural selection through the proxy of watching -- of
20 19 watching adaptations evolve in lineages through time.

21 20 In evolutionary theory, adaptation is defined
22 21 as the result of natural selection. These are features
23 22 that are improved behaviors, functions that are improved
24 23 through the action of natural selection, which is again
25 24 this rubric, r-n-b-r-i-c, that encompasses environmental
26 25 factors, factors of competition, predation, interactions

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2 1 with other organisms to shape succeeding generations.

3 2 And there's also an element of opportunity,

4 3 that is, organisms often change evolutionarily because

5 4 they're able to make use of a new feature in their

6 5 environment that wasn't exploited before, and a lot of

7 6 that is what we see. So when we look at the adaptive

8 7 improvement of structures in a lineage through time,

9 8 we're -- we are making the inference that selection has

10 9 done this. But the generation-by-generation measures of

11 10 selection are done in populations of animals in which,

12 11 for example, we're watching much more small scale

13 12 adaptations, not the ones that takes millions of years.

14 13 Q Okay. Let me make sure I'm following you here,

15 14 to the extent I can. First, it seems, based on your

16 15 answer, that when you say you're looking at the

17 16 mechanism of natural selection, we're sort of -- it's

18 17 precluding from paleontology trying to locate or prove

19 18 out this sort of genetic component of the process,

20 19 that's kind of taken off the table; is that accurate?

21 20 A We can't examine the genetics of the fossil

22 21 populations in that same realm, which is right.

23 22 Q Then you say, you observe a population through

24 23 time. I think you said using adaptation as a proxy --

25 24 A Yes.

26 25 Q -- for selection?

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2 1 Now, if I may, Kevin, are you saying there that

3 2 if a feature persists through time, you infer that it

4 3 has conferred an advantage, that it's been selected, so

5 4 to speak, or --

6 5 A I'm more talking about cases in which we see

7 6 the emergence of a feature that has a demonstrable

8 7 functional behavioral role. If this is -- if this is

9 8 persisting, and even improving or elaborating through

10 9 time, then we presume that there is some sort of

11 10 selective role. There's some sort of advantage to this

12 11 feature. And that, as we say in our common parlance,

13 12 selection is maintaining or shaping that feature.

14 13 Q So the underlying inference is that adaptation

15 14 which persists confer advantages, are a positive

16 15 addition to the species?

17 16 A Yes.

18 17 Q At the end of the section D, you have a

19 18 sentence that says, "The fossil record provides strong

20 19 support for evolution, and has since the mid-1800s."

21 20 Is it proof along the lines that you've

22 21 suggested thus far this morning, Kevin, this notion that

23 22 you can watch a pattern of certain adaptations and

24 23 endurance through time on the part of certain species,

25 24 is that the evidence.

26 25 A Both those things and more.

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2 1 Q Okay.

3 2 A People in the early 1800s, and even slightly

4 3 before then, recognized that the fossil organisms that

5 4 they found in rocks were not uniform from place to place

6 5 and from -- as you went up a rock column either in one

7 6 place or stacking them by correlating them from one

8 7 place to the next, because they are the same things over

9 8 here and then there's more beds below them, and they can

10 9 be inferred to be below the ones that were over here and

11 10 so on. Those -- those fossils, the farther down you

12 11 went, the less they resembled the organisms of today.

13 12 Some of them had no present day counterparts at all.

14 13 Some of them were enormously successful like trilobites

15 14 in rocks that are very, very low in the available

16 15 section, which people came to realize were very, very

17 16 old.

18 17 And so, we see these patterns of waxing and

19 18 waning of replacement of some groups by others as -- as

20 19 the whole support for what used to be called the

21 20 progression of life through time. That progression

22 21 could be explained by any number of ideas. The idea

23 22 that in the early to mid-1800s was given to support it

24 23 was evolution. That is, that things were changing

25 24 through time. And some things were disappearing, and

26 25 some things were forming anew. And that these often

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2 1 resembled things that were already in the preceding

3 2 sediments. So the whole idea of biological evolution

4 3 was actually well in the year before Darwin wrote a

5 4 word.

6 5 Q Okay. On page 10, Kevin, where you discuss

7 6 about Pandas and paleontology, there's a line in here

8 7 that I just want to make sure I understand. It's the

9 8 second full paragraph under subheading C, and it's about

10 9 halfway down the paragraph. And it reads, "The origin

11 10 of major new adaptive types and major groups of

12 11 organisms begins with a single speciation event of very

13 12 few minor structural changes."

14 13 Now, it seems to me, from our discussion this

15 14 morning, the speciation event is the province of the

16 15 genetic facet of the process; is that correct?

17 16 A No.

18 17 Q Okay.

19 18 A Recognizing different species is not solely a

20 19 matter of genetic difference.

21 20 Q Well, what accounts for this?

22 21 A We actually recognize species by different

23 22 criteria. What we call a species is a lineage that is

24 23 distinct from other lineages in essentially time and

25 24 space. Now do we know these things are distinct in time

26 25 and space? We have a series of criteria. For organisms

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2 1 that interbreed with each other, we find that if they

3 2 can no longer interbreed with each other, then they are

4 3 separate lineages or species.

5 4 Sometimes organisms could potentially

6 5 interbreed with each other, but they live in -- they've

7 6 wandered off into different places. And so effectively,

8 7 they're not going to do that any more.

9 8 Sometimes they may live in close proximity, but

10 9 ecologically, they're doing different things, so they

11 10 don't encounter each other so often. And there are

12 11 other ways that people look at this. So the formation

13 12 of species themselves is a process that goes beyond

14 13 simply a genetic assessment to an assessment of how the

15 14 organisms live in the world.

16 15 Q So am I correct that there's -- your answer

17 16 points to two possible sources for a speciation event?

18 17 One is genetic. The other is environmental in the ways

19 18 that you described in that the populations can be so

20 19 distributed that they're no longer going to be

21 20 considered as one species. Is that accurate, Kevin?

22 21 A The words you started with, it can be both

23 22 genetic and other means. Again, I think that our

24 23 characterization is one of lineages that are separate.

25 24 They may have genetic differences. Certainly, they

26 25 probably will to a greater or lesser degree. Sometimes

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2 1 they have very few. But it mainly is a question of, are

3 2 they separate from each other, do they prefer organisms

4 3 that interbreed, do they interbreed with each other.

5 4 For example, we have a concept called sibling

6 5 species. And sibling species are those that you can't

7 6 even recognize if you just put two individuals on the

8 7 table. Two beetles, for example. You may not be able

9 8 to tell their difference at all, or two crickets. And

10 9 they tell their difference because they have different

11 10 mating calls. Or -- so, for example, the two crickets

12 11 may live on the same Hawaiian island right next to each

13 12 other. But the one will have a mating call that its

14 13 females will recognize, but the other females won't.

15 14 The two beetles may be perfectly alike, except--

16 15 one will breed two weeks after the other. So they will

17 16 actually never come into contact again, but they still

18 17 look the same. These are, for all intents and purposes,

19 18 separate species, lineages through time that are now no

20 19 longer the same thing.

21 20 Q Well, what accounts for that kind of event,

22 21 that speciation, I guess you call it?

23 22 A Speciation. What accounts for it? Well, some

24 23 speciation probably has an adaptive basis. That is,

25 24 let's say you have several populations of a plant and

26 25 those plants are distributed and some of them eventually

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2 1 acquire their way from the flatlands up onto the

3 2 hillside where things are a bit -- life is a bit

4 3 tougher, let's say. There's a shorter warm season, the

5 4 winds may be more severe, the soil may not be as good.

6 5 And yet, these populations are adapted to live up there,

7 6 they're happy, they're doing fine.

8 7 Ultimately, they may become so genetically

9 8 different from the ones down on the flats, but even if

10 9 you transplant them, A, they won't do well. And if you

11 10 try to interbreed them, then don't interbreed with

12 11 fertile offspring. That's the classic model of the

13 12 species difference that we would call adaptation.

14 13 Q That's a genetic?

15 14 A It eventually acquires a genetic component to

16 15 it.

17 16 Q Through the selection due to the environmental

18 17 factors?

19 18 A Yes. Selecting on particular genotypes through

20 19 selecting the phenotype that are more adapted to this

21 20 new environment. That's the classic mode of speciation

22 21 that people think about.

23 22 Q Then again -- I'm just -- on page 10 here, you

24 23 say, 'A speciation event of very few minor structural

25 24 changes.'

26 25 Now, there, Kevin, are you referencing -- are

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2 1 you referencing in this sentence, 'The origin of new

3 2 major adaptive types and major groups of organisms

4 3 begins with a single speciation event of very few minor

5 4 structural changes.'

6 5 Is that a reference to genetic changes in the

7 6 subject species?

8 7 A Well, it has a genetic component. But I think

9 8 maybe we should focus on what we call the phenotype,

10 9 which is the appearance of the organism and it's

11 10 behavior and function. This is where the rubber meets

12 11 the road evolutionarily. You can throw a lot of

13 12 organisms out in the world with different genetic

14 13 components. Who survives, in terms of when selection is

15 14 acting, determines -- is determined by the whole

16 15 phenotype and not an individual gene, in most cases.

17 16 The gene will determine the phenotype. The genes will

18 17 determine the phenotype.

19 18 So it's probably better to focus on what sorts

20 19 of phenotypic or differences in form we can relate to.

21 20 Because, as we've established, we're not doing genetic

22 21 studies on long extinct organisms. We have their --

23 22 what's left of their appearances, their form, their

24 23 phenotypes to work with.

25 24 So it's these few structural changes that

26 25 people in evolutionarily biology who look at life on the

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2 1 long run, can work with to sort of see where big

3 2 elaborate adaptation start, which is frequently from

4 3 just a few structure changes.

5 4 Q That's what I'm trying to get. I'm trying to

6 5 understand here. You described this process, these

7 6 changes accumulate. Now, I'm -- what are you getting at

8 7 there? The small structural changes tend to accumulate?

9 8 Give me an example of that, if you would, so I can try

10 9 and follow you.

11 10 A I'm trying to explain that when we have

12 11 sequences of major adaptive change in evolution, the

13 12 kinds of adaptive change that often separate whole great

14 13 groups of organisms, mammals from their closest

15 14 non-mammal relatives, birds from reptiles, how do we get

16 15 across these gulfs? Is it all a sudden change and boom

17 16 there's a full-fledged bird? No, that's not the

18 17 pattern. The pattern repeatedly, as we come to have

19 18 more fossils available to us and better means of

20 19 analyzing them, more complete interdisciplinary ways of

21 20 looking at these questions, we're actually finding that

22 21 these great gulfs that seem to separate living groups

23 22 like that in a fossil record, we actually find features

24 23 that close the gap much more than we could expect. And

25 24 often in ways that we didn't predict.

26 25 Q And you use the term "features." And it seems

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2 1 detail. But as they go into the water more and stay in

3 2 the water more, these limbs on the forelimbs, the hands

4 3 become longer and more like flippers. Where as the hind

5 4 limbs become much smaller and finally are unable to

6 5 support the animal on land. These we would see as a

7 6 change in these features through the lineage of whales

8 7 that we would regard as an adaptation, because we know

9 8 from functional morphology that a flipper-shaped fin is

10 9 good for swimming.

11 10 Q Gotcha. Now, in that same sort of adaptation

12 11 in another beast would not contribute to its ability to

13 12 survive in its environment, and therefore, you would not

14 13 regard it as an adaptation?

15 14 A We wouldn't see it on a horse.

16 15 Q Now, with transitional features, are you -- is

17 16 your point there that you see the features in a number

18 17 of different lines as opposed to -- in other words,

19 18 what's the distinction between the transitional feature

20 19 and the transitional form?

21 20 A That's a good question. The transitional

22 21 features are seen in the lineage of organisms. Not ones

23 22 that are completely unrelated to each other, but ones

24 23 that are related to each other. And we watch these

25 24 features changing in this lineage. The lineage of

26 25 animals we find, let's say, we don't have to find a

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2 1 to me, from reviewing your report, that you

3 2 differentiate transitional features from transitional

4 3 forms.

5 4 A That's a very good distinction. I'm really

6 5 glad that you got that. Because that's a very important

7 6 point that is lost on a lot of people.

8 7 Q And plainly, that's one of the issues here.

9 8 I'm just trying to understand. It seems from what you

10 9 said earlier, that if you watch a feature persist

11 10 through time, you're regarding that as an adaptation?

12 11 A We regard it as an adaptation if we can

13 12 identify some functional or behavioral utility. We can

14 13 see it as an adaptation if we see it improve or change.

15 14 For example, from something where there doesn't seem to

16 15 be a specific function to acquiring this new function.

17 16 In other words, we can look at the -- we can

18 17 look at the forelimb of the animals that eventually

19 18 became whales, the earliest whales. And we identify

20 19 them as whales, even though they're animals that are

21 20 walking around on land like horses and cows, although

22 21 they don't look like horses and cows. On the basis of

23 22 features of their skulls and teeth that align them with

24 23 later whales. In other words, these are basic

25 24 synapomorphies of whales. As these early whales begin

26 25 to go into the water more, which I can explain the whole

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2 1 specific linear ancestor. It may be an uncle off the

3 2 path here, but he may share these synapomorphies with

4 3 all the later whales. And so, he'll tell us a lot about

5 4 what the quote/unquote direct ancestors, which we may or

6 5 may not find, actually were like.

7 6 Q So, Kevin, just so I understand, with -- when

8 7 you make these judgments involving that funny word of

9 8 shared features, how are you doing that as a

10 9 Paleontologist, what criteria are you using to place

11 10 some particular specimen or -- in a given family or

12 11 line?

13 12 A Right. We're using the synapomorphies from all

14 13 parts of the available material. By which, I mean the

15 14 skull and the skeleton, all the bones that are available

16 15 to us. For example, when I was talking before about the

17 16 forelimb changing, we wouldn't just line up forelimbs in

18 17 a sequence and say, that must be the way they evolved.

19 18 We would have to look at all the characters of the

20 19 skull, the teeth, the vertebrae, the ribs, the pelvic

21 20 girdle, the hip, the hind limb, the feet, the tail.

22 21 We'd actually -- we say code, and we mean specify the

23 22 condition of those features, describe those features,

24 23 and put descriptions, coded descriptions, of every one

25 24 of those features into a big data matrix. And then we

26 25 essentially ask the computer to sort out which things

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2 1 share the most synapomorphies.

3 2 In fact, if we're asking questions about the

4 3 forelimb, we might even take all the forelimb data out

5 4 of that matrix and just run it on the other things,

6 5 okay, so that we have our answer; we have an answer that

7 6 describes for us who is sharing the most synapomorphies

8 7 in this group. How are these things branching off with

9 8 each other and from each other? And then, we can, if we

10 9 like, ask the question, well, what does that tell us

11 10 about the changes in the forelimb through time? Are we

12 11 seeing a single change from the simple standing leg to a

13 12 big flipper or is the pattern somehow different? And

14 13 the idea that -- the idea is that we test ideas about,

15 14 for example, forelimb evolution, by comparing them to

16 15 the distribution of differences in all of the features

17 16 of those organisms. Does that help?

18 17 Q If not, it's not for lack of trying. Let me

19 18 just try and understand.

20 19 A Sorry. It's really abstruse.

21 20 Q In terms of the process you described, and if

22 21 we take the whale as an example, if I look at the way

23 22 this classification is looking for shared transitional

24 23 features and so on, works, is it -- do I understand you

25 24 correctly, you measure, sort of quantify and classify

26 25 the individual parts or attributes of the subject of

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2 1 your examination, and then you compare those. You've

3 2 got classifications that are set out for each of these,

4 3 the forelimb and other, the skull, the teeth and other

5 4 parts, you load all the data, as you say, and then,

6 5 based on a doubtless complicated sorting process, try

7 6 and see the greatest overlap of features, which, in

8 7 turn, points to the most likely lineage for that

9 8 particular subject?

10 9 A That's basically it.

11 10 Q Okay. So the -- in that case, I guess, there's

12 11 sort of reason judgement that's being made based on sort

13 12 of the weight, the center of gravity, or the

14 13 preponderance of what appear to be shared features. Is

15 14 that accurate?

16 15 A The presumption is that the more shared new

17 16 features that organisms have, the more recent their

18 17 common ancestors have been. If two organisms share 46

19 18 of these things and they only shared two with somebody

20 19 else down there, then they're presumed to be more

21 20 closely related as an extreme example.

22 21 Q Sure. When you say "more closely related,"

23 22 there's obviously -- we focused on the feature

24 23 comparison component of that analysis. Are there other

25 24 components that you use?

26 25 A In living animals, increasingly. Analysis of

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2 1 the genetic material itself is used. So the DNA/RNA

3 2 segments can actually be looked at. Specific genes can

4 3 be sequenced. The specific parts of the geno can be

5 4 looked at. And these comparisons, again looking for

6 5 shared derived features of the geno, provide a

7 6 tremendous wealth of information far beyond what we can

8 7 get from the skeletal parts, because there are simply so

9 8 many genes.

10 9 Q Okay. But then, again, you've got this

11 10 fascinating portion of your report here dealing with the

12 11 whales and whether they could have an aquatic or

13 12 terrestrial ancestor. And the point of that, if I'm not

14 13 correct, is that the molecular biology has its limits,

15 14 also, in positing these lineages. It simply can't -- at

16 15 least, if I'm understanding it correctly, it can point

17 16 to a certain shared ancestry, but it cannot really

18 17 pinpoint certain features of that shared ancestor at

19 18 all?

20 19 A To the extent that genetic analysis is not

21 20 possible for completely extinct animals, that's true.

22 21 So for example, in the whale -- in the case of the

23 22 whale, the most recent molecular analyses were telling

24 23 us that whales and hippos are each other's closest

25 24 relatives, which is really hard to believe for many

26 25 people. Simply because they are so different. But of

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2 1 course, whales are different from everybody now. But if

3 2 you go back 50 million years to the Eocene, they weren't

4 3 that different from other kinds of hoofed animals

5 4 running around, which also didn't look like hippos of

6 5 today.

7 6 Hippos are only found in the fossil record for

8 7 maybe 15 million years. Whales are first known over 50

9 8 million years ago. So we've got a 35 million year gap,

10 9 where are the hippos. And it turns out that only

11 10 fossils can tell us that hippos are members of a larger

12 11 extinct fossil group. I won't bore you with the name.

13 12 And that these guys are related to the early whales.

14 13 But there's no trace of them in the living fauna. So

15 14 molecular analysis couldn't assess them.

16 15 Q It cannot go back. As you say, you just don't

17 16 have the genetic material needed to plumb that line?

18 17 A On the other hand, molecular analysis is

19 18 correctly giving us two things. One, is the fact that

20 19 hippos and whales are each other's closest living

21 20 relatives, which is great. And the other thing is, that

22 21 the degree of their divergents, the degree of their

23 22 molecular genetic differences implies that they diverged

24 23 from each other maybe 50 million years ago, which is

25 24 about what we would calibrate from the fossil record

26 25 just because they're genetically so different. So it

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 2 1 really is telling us a lot of this.
 3 2 Q In terms of the inference you can make from
 4 3 that?
 5 4 A Yes. It's consistent, in other words.
 6 5 Q And in terms of the role that paleontology
 7 6 played in making this judgement as to whether or not the
 8 7 original shared ancestor of the whale and the hippo was
 9 8 terrestrial or aquatic, am I correct that that judgment,
 10 9 in turn, rests on this process you described of tracing
 11 10 out the lineages based on shared features?
 12 11 A Yes.
 13 12 Q Let me ask you again, trying to understand the
 14 13 basis for your opinion here. At a couple points in your
 15 14 report on page 2, for example, you point out that Darwin
 16 15 was not -- let me see if I can find this. He wasn't
 17 16 principally concerned with new major adaptive types,
 18 17 that wasn't -- and you say that, I think, on page 2 and
 19 18 3 and then later on page 10; is that correct?
 20 19 A Yes.
 21 20 Q Now, on the other hand, on page 5 of the
 22 21 report, when you're dealing with Intelligent Design
 23 22 Theory, or IDC as you call it, you're -- you dismiss the
 24 23 distinction that they make between macro and
 25 24 microevolution. What I'm trying to get at there, Kevin,
 26 25 is what -- on the one hand you seem to be recognising

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 2 1 Kartooste, Springbok, things like that. There's a lot
 3 2 of them, and they have a lot of funny names. But they
 4 3 have a great diversity of horn shape. And they have
 5 4 been a much more successful group than the Impalas in
 6 5 terms of species diversity through time.
 7 6 Macroevolution might ask the question, why
 8 7 should that be, what is contributing to the success of
 9 8 one over the success of the other, are they better at
 10 9 running, are they better at feeding, do they have better
 11 10 ruminant stomachs, or is it just that this head gear
 12 11 enables them to make more species because they recognize
 13 12 differences and form new lineages.
 14 13 These are the kinds of questions that you can't
 15 14 ask by looking at individuals in populations. And
 16 15 there's nothing magical about it. We're still dealing
 17 16 with individuals who are changing and passing on their
 18 17 genes. But the phenomena are a little bit more large
 19 18 scale. And I kind of think about it a lot like
 20 19 economics. We have microeconomics and macroeconomics.
 21 20 Q What -- let me ask you, is it -- it's not so
 22 21 much, in my understanding here, it's not so much the
 23 22 distinction between macroevolution and microevolution,
 24 23 it seems like that, in your opinion, there is a basis
 25 24 for that distinction; is that accurate?
 26 25 A There is a distinction in the hierarchical

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 2 1 that there's a distinction. And on the other, you're
 3 2 plainly somewhat disapproving of this component of
 4 3 Intelligent Design Theory. What are you getting at
 5 4 there, what is your --
 6 5 A IDC supposes that the kinds of changes that
 7 6 separate major groups of organisms are not tractable to
 8 7 evolutionarily solutions. And so they posit that in
 9 8 these cases, there must be some other causal agent about
 10 9 which we know nothing, but it has an intelligence. And
 11 10 I think that scientists would characterize
 12 11 macroevolution not as huge changes, but rather as
 13 12 changes that occur in groups once you reach the level of
 14 13 species.
 15 14 In other words, individual in a population is
 16 15 microevolution, changing from generation-to-generation.
 17 16 Once you get separate species, and you're talking about
 18 17 how those lineages behave through time, you're talking
 19 18 about macroevolution. And an example might be, let's
 20 19 say we have some horned animals, and that one group
 21 20 looks like the Impalas, and they have fairly simple
 22 21 lightly curved horns. This lineage, going back in the
 23 22 fossil record, seems to be pretty much Impalas all the
 24 23 way. Back 10, 15 million years in Africa, they look
 25 24 pretty much like Impalas. That lineage is related to
 26 25 another lineage that includes the Wildebeest, the

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 2 1 level in which we're studying things.
 3 2 Q Okay. One within the species, that's
 4 3 microevolution, and the other, macroevolution, would be
 5 4 changed between species.
 6 5 Now, Kevin, is that what you refer to as a
 7 6 speciation event, those -- or the result of a speciation
 8 7 event?
 9 8 A We would say that macroevolution is the
 10 9 interactions among species. We have to begin the
 11 10 discussion of macroevolution with the speciation event
 12 11 because that's what produces new species, as opposed to
 13 12 below the speciation level. We're talking about
 14 13 individuals in populations.
 15 14 Q Let me ask you, when do you -- how do you make
 16 15 the judgement that's there's been a speciation event?
 17 16 A When we recognize two organisms as separate
 18 17 species, which we do according to the criteria we
 19 18 discussed before.
 20 19 Q So that's the interbreeding criteria, there's
 21 20 no longer interbreeding?
 22 21 A That's one criteria, yes.
 23 22 Q What were the other, there was nonrecognition,
 24 23 sort of?
 25 24 A Exactly. There's ecological differences,
 26 25 geographical differences, sure.

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Q Okay. So am I correct then, that the objection here you have here on page 5 of your report, used -- related to the use of the terms "macroevolution" and "microevolution" by the proponents of Intelligent Design Theory, is based on what you said earlier, that in your judgment, Intelligent Design Theorists see macroevolution as intractable, as you put it, to evolutionarily solutions?

A Because they see it as an entirely different kind of process that creates big changes. That is not the definition of macroevolution that scientists use.

Q Okay. What is the definition of macroevolution, just so I have it down?

A I would define it as the study of patterns and processes in lineages of organisms above the species level.

Q So -- and that is, I think, what you're referring to in several portions of your report where you say how new major adaptive types emerge?

A Yes.

Q That's the subject of macroevolution?

A That's one of them, sure. Mass extinctions might be another.

Q Okay.

A And there are many other kinds of subjects,

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1 this level of macroevolution is really just a sort of a
2 quantitative accumulation of microevolution?

A In many respects, yes. And I also -- and without contradicting that statement. What I want to say is that macroevolution studies a different hierarchical level of phenomena than microevolution does, microevolution being concentrated on the population level changes, and macroevolution being concentrated on higher levels of related groups and their environments through time.

Q And just again, this is kind of simple, but forgive me, I'm trying to follow you here. When you say that paleontology is providing support for evolutionarily theory, that's what you're getting at, is this observable pattern that you found here in the fossil record, in your opinion, demonstrates the result of the process of biological change in natural selection?

A That's a big part of it, yes.

Q What are the other parts?

A Well, the other elements of macroevolution that we haven't talked about include things like that, the documentation of mass extinctions. That's a big subject in evolutionarily theory that can only be assessed by macroevolution. It doesn't apply, of course, in any

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1 biogeographical change. For example, how marsupials got
2 from North America to Australia and South America.
3 Through time, these are important questions --

Q Okay.

A -- that we ask, yeah.

Q Again, those are either genetic or environmental?

A Functional.

Q Functional changes. I'm sorry, Kevin.

That account for a speciation event; is that correct?

A I wouldn't say they account for speciation events. They presuppose that species exist and they're often concerned with the patterns of how these species are deployed in space and time, the processes by which they get there or survive, and the mechanics of organisms that allow them to make a living and survive in their various environments.

Q And is your principal difference with the IDT -- short for Intelligent Design Theory, from here on out -- is that they don't -- they don't see that macroevolution as being accountable for by evolutionarily theory?

A Yes.

Q Where as, it seems your opinion is that the --

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1 way, to the population level.

2 When you find a point in time where there is a
3 substantial proportion of living organisms becoming
4 extinct in a relatively short time, we identify those as
5 mass extinctions statistically, actually, by virtue of
6 what a big excursion it is from normal extinction rates.
7 The study of mass extinction is another area of
8 macroevolution that's very important.

Q Okay.

A But mass extinction is not really on the table for IDC proponents, because they're more interested in questions of how life evolves than it how it gets souffed out.

Q In other words, as I understand you there, since their focus is on trying to explain the mechanism of change, they're not, from a genetic standpoint, a biology standpoint, that find themselves less concerned with some of these environmental factors that you've pointed to, which can, if I understand you correctly, just as readily explain why a given species endures through time?

A Well, I'd say that their issue is more focused on origins than anything else. And origins is one part of macroevolutionarily study. And as we've seen, there's others. Such as extinctions, such as geographic

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1 change in the distribution of species. And yes, the change in their climate and things. And IDC is not really terrifically concerned with those things. They tend more to focus on the process of evolutionarily change itself and whether our understanding of this can account for the differences among organisms.

Specifically, what I'm taking issue with here, is the characterization of macroevolution. Because it suggests, A, that it must be a completely different kind of change. As you put it, genetic change, that is possible for them. Whereas, biologists don't seem to think. There's no evidence that says it's really different. It says that, rather, it's more a net effect of cumulative changes in a lineage in structure and function and behavior through time that result ultimately in differences that do seem to separate groups of organisms that once were fairly similar.

Q Does -- can paleontology prove that process you just described?

A If I could just say that I don't -- I think the word 'prove' should be reserved for mathematics.

Q Okay.

A But that's right.

Q Pardon me. I'm using it as a layman.

A No. Because scientists do -- many scientists,

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1 comparable to what is in populations demonstrated by natural selection. It's just that, as I explained before, we can't measure the power of selection in fossil populations. This is on a bigger scale. I can give you an example.

Q Do, please.

A We can look at the evolution of the wing in birds as an example of this. The wing involves several things. The bones of the arm and the fingers, the hand, those are changing. Feathers are evolving. They have to form a wing, an airfoil that's capable of supporting the animal in the air. There has, also, to be a flight stroke that is movement of the forelimbs that actually powers the animal forward. This is a very precise motion in order to make this work. And there are also changes in the neuromuscular components, the brain, the physiology, the base on metabolism. All these things are built into how we understand flight-originating birds.

And we now have small dinosaurs that are not birds, but are closely related to them, and they have feathers. They have feathers of different shapes, forms, sizes. And these feathers are not as big as the feathers on bird's wings, nor are the arms yet quite as long as they are in birds, even the first birds. And

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1 chemistry, physics, especially working on experiments, do talk about proof. I prefer to sort of use the term 'support' or 'establish' or 'demonstrate,' by which we mean that certainly our conclusions are open to modification, but it's a pretty good show.

Yes. I think paleontology can do this in many cases. Paleontology will broadly to incorporate elements of functional morphology, physiology, comparative anatomy, which is all the stock and trade of Paleontologists, even though they are also studied as separate disciplines.

Q Let me -- I'm trying to figure out the ways in which, when you look at paleontology and it sort of -- well, let me ask you this, can it prove or can it sufficiently demonstrate, to your satisfaction, sort of the mechanism of natural selection?

A Again, I would prefer to use the demonstration of adaptation as a proxy for showing selection. Evolutionarily biologists and, in particular, those who work on microevolution, have defined adaptation as the result of natural selection, because they see this in their population studies. We, as Paleontologists, don't contradict this but, rather, what we're seeing is larger scale adaptive changes. Each one of which, when broken down into smaller components, may be as

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1 what we see with these, with the evolution of these feathers, is that they're not evolving all at once. They start out small and very simple. Almost as hair like filaments. They're all over the animals body, and they would have been a kind of insulation.

So the first thing we determine is that the original function of the simplest feathers was insulation. They then become branched, and they have a central kind of stock, the same way a feather does today. And the -- these feathers are simple, too, but we find banded color patterns on them. By which we infer that they had a role in display, camouflage, or allowing individuals to recognize members of their own species.

We have fossils of dinosaurs sitting on their nests of eggs, in which position they died, for whatever reasons. They're spreading their fingers over their eggs. These fingers in related dinosaurs have long feathers coming off them, by which we infer that these feathers also serve to protect the eggs when dinosaurs were brooding. So here are three functions of feathers that are simpler than the feathers in a bird's wing that evolved before feathers and such were used for flight.

So we're looking at a sequence of cumulative changes as feathers eventually become larger and more

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2 1 complex and finally, air worthy. And eventually, the

3 2 function of flight evolves, as well.

4 3 Q Let me stop you there and ask you a few

5 4 questions to see if I'm with you. First, when we

6 5 started out talking about whether paleontology could

7 6 show the mechanism of natural selection, and I think

8 7 what you said there is, not directly, but you use

9 8 adaptation as a proxy for that?

10 9 A That's right.

11 10 Q By looking at the persistence of a given

12 11 adaptation, which I think results in the enduring, if I

13 12 may say that, of transitional features; is that correct?

14 13 That -- once that becomes adaptive, it's a positive

15 14 thing. So that's how -- that's the way in which

16 15 paleontology tries to put its finger on the mechanism of

17 16 the natural selection?

18 17 A (Witness nods head.)

19 18 Q That's a yes?

20 19 A Yes. That's as close as I think we can get.

21 20 Q Okay. Now, here with the feathers -- I was

22 21 going to ask you about this, because this is absolutely

23 22 fascinating. What you seem to be saying is, that there

24 23 are features that are developing, which initially don't

25 24 have a function, they acquire later on. That's one

26 25 thing. But as I trace through that process which you

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2 1 sketched out here and given a lot of time and thought

3 2 to, it seems like at every stage in the process, you're

4 3 inferring a function that allows the -- if we could

5 4 call -- I don't know what you call, I'm sure you have a

6 5 word for them -- the precursor to the feather, to

7 6 develop, it's got a function. And that's, you're sort

8 7 of weighing the evidence. You should make those

9 8 inferences. The first you say are hair-like?

10 9 A Yes.

11 10 Q All right. And you have inferred, you made a

12 11 reasonable judgement, if I may, that that's probably an

13 12 insulation function?

14 13 A Yes.

15 14 Q Okay.

16 15 A Because, if I may add. By comparison to

17 16 similar structures in living animals, hair-like fur in

18 17 mammals, hair-like feathers in things like Kiwis, very

19 18 simple feathers, these have an insulator function.

20 19 Q Okay. Then the same thing as you go along

21 20 through the -- as you trace out the process at each

22 21 stage, you're looking at what you see in the fossil

23 22 record in light of what you see in other fossils, and

24 23 then it appears current living animals with a similar

25 24 feature?

26 25 A Yes. And so in birds, we observe that feathers

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2 1 have many functions, some of which we can track now in

3 2 these extinct dinosaurs that weren't birds and didn't

4 3 fly, but were closely related to them.

5 4 Q You know, as I look at your description of the

6 5 fossil record, what is the -- what does punctuated

7 6 equilibrium show about natural selection, does it show

8 7 anything?

9 8 A I wouldn't think so. I think it more is an

10 9 idea that describes the pace of what we call

11 10 morphological change. That is, change in features of a

12 11 lineage.

13 12 Q Okay. As opposed -- now, when you say change

14 13 in features of a lineage, is that new species or not?

15 14 A The -- it is an idea about speciation that's

16 15 based on morphological change. So here is a lineage

17 16 that basically is not changing very much through a long

18 17 period of time. Then in a relatively short period, it

19 18 seems to make a change that distinguishes it comparably

20 19 as a new species. In other words, the new guy is

21 20 distinct enough from the old guy that it would be

22 21 characterized as a species by anyone who looked at it

23 22 with a professional understanding. And if -- and how do

24 23 we know that these things really are species in the

25 24 fossil record? We quite often do it by comparing them

26 25 to related living forms to see if they actually have the

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2 1 same kind of and degree of differences. And it turns

3 2 out that the studies that have been done say, yes, they

4 3 do. So they are consistent with difference we see in

5 4 species today.

6 5 Q Okay. And you sort of read those back into the

7 6 fossil record and say, these are more -- this difference

8 7 between fossils is more kin to the difference we see in

9 8 these two living examples?

10 9 A Yes.

11 10 Q Okay. And we know these two living examples

12 11 are a different species for a variety of reasons. And

13 12 therefore, we infer that these fossils -- remains must

14 13 also be.

15 14 A Yes. And therefore, for animals that are

16 15 completely extinct, we use the same kind of degree of

17 16 difference --

18 17 Q Okay.

19 18 A -- to establish that.

20 19 Q Okay. To establish the classification as a

21 20 different species?

22 21 A Yes.

23 22 Q When you -- again, I'm just trying to

24 23 understand. Does -- is there a theory in paleontology

25 24 as to how this punctuated equilibrium relates to the

26 25 mechanism of natural selection? I mean, can it be

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 2 1 accounted for by the existing theory?
 3 2 A This is going to get complex. I'm sorry. But
 4 3 when --
 5 4 Q Is it yes it can?
 6 5 A It can.
 7 6 Q Can exist in theory account for punctuated
 8 7 equilibrium?
 9 8 A Yes.
 10 9 Q Just give me as brief an explanation as you
 11 10 can, so I can --
 12 11 A When it was proposed, the idea was that the
 13 12 reason that you're seeing no change for a long time is,
 14 13 basically, that organisms are more or less happy with
 15 14 what they're doing. So they don't change very much.
 16 15 One possible explanation that was proposed is that a
 17 16 population on the fringe of the whole range of the
 18 17 species diverges in form from the others. This can
 19 18 happen quickly in semi-isolated small populations,
 20 19 particularly. Evolution can happen especially fast
 21 20 in -- that was always the prevailing understanding.
 22 21 And then the idea was that this fringe
 23 22 population could then come back into the main range and
 24 23 sort of swamp or take over, out compete, or for
 25 24 selective, or whatever reasons, take over that parent
 26 25 population's range, and then persist through time after

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 2 1 you see it, is an open question in paleontology at this
 3 2 time?
 4 3 A No. It's been demonstrated in a great number
 5 4 of cases. The question is, has it been assessed for all
 6 5 possible cases. And the answer is, no. It's still a
 7 6 fraction. We have a quarter of a million species in the
 8 7 fossil record. Some of them, you could ask that
 9 8 question of. Many of them, you could see not. But the
 10 9 number of cases that you could ask that question has not
 11 10 been fully assessed.
 12 11 Q So again, just so I understand you, is it your
 13 12 view that, in light of these difficulties you've
 14 13 described, some of which it appears arise from the
 15 14 incompleteness of the fossil record versus, in certain
 16 15 areas, it's not yet clear whether punctuated equilibrium
 17 16 is a general characteristic of evolutionarily change?
 18 17 A It's not clear whether it's more common than
 19 18 gradual change. And if so, how much more common.
 20 19 Q Okay.
 21 20 A Does it apply to 90 percent of cases or 40
 22 21 percent of cases? In either case, whether you have a
 23 22 punctuated pattern or a gradual pattern, selection could
 24 23 still be working.
 25 24 Q And I guess that's -- that's, you know, again,
 26 25 what I was trying to get you to explain to me, is how

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 2 1 that. That supposition or idea is very difficult to
 3 2 test, but it was based on the prevailing understanding
 4 3 from population biology of the 1950s, 1960s and earlier,
 5 4 that established that this could happen in populations
 6 5 today. Therefore, the suggestion was made that maybe
 7 6 this is what's going on in fossil population, but we
 8 7 couldn't directly test it.
 9 8 Q But that is the way, currently, paleontology
 10 9 deals with this notion of punctuated equilibrium, that's
 11 10 the sort of working hypothesis, if I may?
 12 11 A It's one idea, Pat, but I don't think it's one
 13 12 that's very strongly explored, because it's just very
 14 13 difficult to get information about that stuff. It's --
 15 14 questions about punctuated equilibrium relate much more
 16 15 to the pattern that we're describing of not gradual
 17 16 change into the new form but, rather, persistence of a
 18 17 form, and then fairly rapid change and then persistence
 19 18 after that.
 20 19 Right now, Paleontologists, when they work on
 21 20 this question, are still trying to ask whether this is
 22 21 the prevalent pattern in the fossil record, how common
 23 22 is it, how rare is it. We need a lot more information
 24 23 about that.
 25 24 Q Okay. So I understand you, is it -- in other
 26 25 words, the very existence of punctuated equilibrium, as

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 2 1 does punctuated equilibrium fit in with the selection
 3 2 process that we've discussed today? Now -- at least how
 4 3 do paleontology see that?
 5 4 A I don't know that it's been extensively
 6 5 explored.
 7 6 Q Do Paleontologists -- I'm sorry. Were you
 8 7 done?
 9 8 A That's all I can say about it. I don't know if
 10 9 it's been extensive.
 11 10 Q Is there --
 12 11 A It's a good question.
 13 12 Q That's a good question.
 14 13 Is there a working -- you've described this
 15 14 notion of the range, a group on the periphery, you know,
 16 15 and so on, sort of displacing the parent population
 17 16 based on an advantage they received while on the fringe
 18 17 of the range, as you put it, and indicated that, in some
 19 18 measure, that sort of working hypothesis was derived
 20 19 from sort of current observable evolutionarily
 21 20 phenomena. Is there any other hypothesis that's being
 22 21 worked on?
 23 22 A Let me say first to maybe clarify your earlier
 24 23 question. That the very process of coming in and
 25 24 replacing, out-competing, or whatever, if that model
 26 25 were correct, would be a selective process.

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2 1 Q Okay.

3 2 A Could we observe the selective process in the
4 3 fossil record, no. We could observe its effects and
5 4 infer selection is one possible mode. Would there be a
6 5 difference between punctuation and gradual change in
7 6 that regard? No. Because gradual change of a
8 7 population was also traditionally understood to be the
9 8 result of selection, little by little on a lineage
10 9 moving through time. The same kind of selection that
11 10 people have observed in population cages in the wild and
12 11 in laboratories for flies, flour beetles, and so forth;
13 12 and that Darwin wrote about, early in the origin of
14 13 species when he was talking about domestication of
15 14 plants and animals, which is known by the term
16 15 'artificial selection,' but it has the same effects as
17 16 his natural selection, when he posits it.

18 17 So to come back to your question, does
19 18 punctuated equilibrium involve selection? By inference,
20 19 it would, as gradualism would. It just would act in
21 20 slightly different patterns.

22 21 Q Okay. And then in terms, again, if I -- I'm
23 22 trying to look at this mechanism, the mechanism of
24 23 natural selection. Again, I just want to make sure. It
25 24 seems like there's some genetic event that produces a
26 25 change; is that accurate? And then, there's the

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2 1 interplay between that genetic change and the
3 2 environment, which confers the advantage, and results in
4 3 selection; is that an accurate --

5 4 A I would say that change -- let's see. Change
6 5 can happen for several reasons. The environment can
7 6 force it, for want of a better word. Either you do this
8 7 or you become extinct. Or, it may present an
9 8 opportunity to which variations that organisms can
10 9 express might be able to take advantage of. I know that
11 10 syntax was convoluted.

12 11 So it's -- it can work in both ways. We cast
13 12 evolution as genetic change, and that's true because
14 13 it's all heritable. We often perhaps underplay the
15 14 importance of behavior, flexibility in evolution. If
16 15 the phenotype is not flexible, that is to say, if
17 16 organisms cannot react to changes, obstacles, and
18 17 opportunities in their environment, then they won't have
19 18 as much success as those that can take advantage of
20 19 change. And so behavior is a big -- and I think, in so
21 20 far as it regards flexibility, is a big part in here,
22 21 too.

23 22 Those plants we talked about before that find
24 23 their way up to the mountaintop, we know that sometimes
25 24 they will be stunted because the conditions are harsh,
26 25 but if we take some of their seeds and plant them back

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2 1 on the flats, they'll grow perfectly fine in the next
3 2 year. All this is telling us is that the organism is,
4 3 that is the individual itself, is experiencing insults
5 4 to its growth by the environment, the same way we would
6 5 by scars or injuries or damage as we would be growing
7 6 up. But through time, if there are variations in those
8 7 populations that -- that naturally make these plants
9 8 shorter or able to withstand cold more or able to bloom
10 9 faster, those variations in the population, which
11 10 incidentally, are mutations, they are simply alternative
12 11 forms of genes, like we see all through our populations.
13 12 Then those would be selected upon, and that will become
14 13 a genetic hardwired thing, so that when you transplant
15 14 those seeds down to the flats, they will still be
16 15 stunted, they'll still be short plants like they were up
17 16 in the hill.

18 17 Q Okay. So that's -- and that is what I'm just
19 18 trying to get a handle on here. It's -- that component
20 19 is when we would traditionally think of it as a
21 20 different species; is that correct? When it's -- it's
22 21 acquired or made its own, these changes that allow it to
23 22 do well in the new environment on the mountaintop, but
24 23 not in the old environment?

25 24 A Whether they are a new species is a proposition
26 25 that we could test. We could examine that, and we would

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2 1 do it by trying to cross them. If they could not
3 2 reproduce, then we would say, yes, of course, they're
4 3 separate species. If they couldn't reproduce, but they
5 4 were up here in the mountaintop and down here and they
6 5 really weren't going to practically do that anymore,
7 6 then we would see them as different species for
8 7 geographic and ecological reasons.

(Recess.)

9 BY MR. GILLEN:

10 9 Q Kevin, I want to see if I can wrap up this part
11 10 of these questions. Which, again, I ask you to forgive
12 11 me. I'm just trying to understand your discipline.
13 12 As seems -- is this true that -- we've
14 13 discussed a number of facets or dimensions that come
15 14 into play in describing evolutionarily change in
16 15 species, and it seems like one element of some of our
17 16 discussion is focused on this genetic facet of it; the
18 17 role of genes and producing the -- certain changes. And
19 18 based on what you said, I would -- is it accurate that
20 19 particular facet of the process, that's not the
21 20 principal subject matter of paleontology?

22 21 A The gene structure, no.

23 22 Q Okay. And the mechanism of gene change?

24 23 A Correct.

25 24 Q And then, we've discussed this mechanism of

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2 1 natural selection. And I've been trying to understand

3 2 how paleontology speaks to that. And I think -- I want

4 3 to see if I've understood your testimony so far. It's

5 4 that it -- paleontology identifies the fact of selection

6 5 by tracking these changes, looking at, I believe you

7 6 called "the proxy of adaptation"?

8 7 A I think that's accurate, yeah.

9 8 Q Okay. And then, as I was thinking about your

10 9 testimony this morning over the break, it occurred to me

11 10 that that, in a way, the mechanism of the -- the

12 11 mechanism of the selection, what makes a change

13 12 advantageous is likewise, sort of a subject of

14 13 reasonable inference on the part of the Paleontologist.

15 14 He sees the pattern of adaptation, he infers that

16 15 there's selection at work, and then, along the lines

17 16 that you've testified to this morning, you sort of use

18 17 what you know from various disciplines, current species

19 18 and the like, to make an inference as to what the

20 19 precise mechanism of selection was in a given case; is

21 20 that accurate?

22 21 A What the selective forces are, what we might

23 22 say.

24 23 Q Okay.

25 24 A Or what the opportunities were that were being

26 25 taken advantage of. And we look at that, as we

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2 1 discussed, by studying functional, elaboration change,

3 2 "improvement," in quotes.

4 3 Q Okay.

5 4 A In a lineage through time. And you're right

6 5 that -- although, we don't directly study the genetics,

7 6 we are working on what are obviously heritable changes,

8 7 not simply accommodation to local conditions by any

9 8 given organism at a time, sure.

10 9 Q So now -- then we have this work that you've

11 10 done on the wing. And I began to read it, and forgive

12 11 me, but it's fascinating, but I can't follow it all the

13 12 way through. If I look at that, as an example, I see

14 13 you as applying the principles we just thought of as

15 14 looking at the changes, and then because they're

16 15 enduring, your mind as a Paleontologist, looking for,

17 16 well, why would that be, what advantage could be

18 17 presented by this developing feature; is that accurate?

19 18 A Well, we look at -- you're correct that when we

20 19 look at similar features in, for example, feathers and

21 20 other structures of living birds, we can get a better

22 21 sense of what those things might have done as the same

23 22 structures in dinosaurs that weren't flying.

24 23 Q Okay.

25 24 A So it's not just looking at the structure and

26 25 making a guess about -- or an inference about things.

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2 1 It's rather reasoning based on comparative evidence. So

3 2 we know what the functions of the feathers of different

4 3 shapes are in birds today, we can look at those same

5 4 structures in fossil animals and go, oh, well, that's

6 5 probably what they were doing there. In the case of

7 6 these little hair-like feathers even that cover the

8 7 whole body, we know these are de facto insulation. They

9 8 would have to be insulator or they couldn't simply exist

10 9 on the body and not have something to do with warming or

11 10 cooling. Yeah.

12 11 Q Okay.

13 12 A Okay.

14 13 Q And then, let me just get that so that I

15 14 understand you. When you say we know they're

16 15 insulation, because you're saying the fact of their

17 16 existence, they have to either warm or cool based on

18 17 what we know about hair?

19 18 A Hair and feathers today, that's right.

20 19 Q Okay. And then -- but if you see them enduring

21 20 through time, and therefore, being properly classified

22 21 as an adaptation, I believe, something that's a positive

23 22 development; is that accurate, Kevin?

24 23 A I think we can call them adaptations if we can

25 24 show that their structure as a change from a previous

26 25 structure would confer some function that wasn't there

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2 1 before, then we can start talking about new functions,

3 2 which, presumably, are adaptive. Because if they were

4 3 maladapted, bad for the organism, presumably, they

5 4 wouldn't have survived. And if they were of neutral

6 5 value, why would they be there at all in the first

7 6 place.

8 7 Q All right. And that's exactly what I was

9 8 trying to get a handle on. There's an inference that if

10 9 they're enduring, they're conferring an advantage,

11 10 because otherwise they drop off?

12 11 A We do this for some features. We don't pretend

13 12 that every confirmation of every structure has a

14 13 function that's incredibly adaptive. Otherwise, we'd

15 14 lose our minds. But we don't -- for example, the shape

16 15 of the bridge of the nose, we could make up stories

17 16 about it being adaptive, but frankly, they don't work.

18 17 And they -- the bridge of a nose is not there in order

19 18 to hold your glasses. So we kind of draw that line at

20 19 some -- at making inferences about everything.

21 20 Q And in that line, Kevin, is it drawn -- just

22 21 along the lines here, your answer suggests sort of a

23 22 plausibility. Is there a plausible explanation to be

24 23 advanced for the feature to be understood as

25 24 advantageous?

26 25 A We generally focus on adaptations that we think

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 2 1 are of some strong ecological or functional importance
 3 2 like wings, ears, flippers, just things that help an
 4 3 organism in the way it performs so much of its daily
 5 4 life. We may not worry about the configurations of more
 6 5 minor features in every respect, you know, the shape of
 7 6 the ear lobes is not something we worry about as an
 8 7 adaptive question.
 9 8 Q Okay. Now, let me ask you, too, when you're
 10 9 looking at these -- the forces of selection, then,
 11 10 again, is that the subject of reasoned inference on the
 12 11 part of the paleontologist?
 13 12 A Yes. I would say that evolutionarily
 14 13 biologists of all kinds, those that work on populations
 15 14 or genetics, would accept that when paleontologists
 16 15 study the evolution of an adaptation, like the wing or
 17 16 the flipper or whatever, that this is the result of
 18 17 natural selection, even if we can't directly measure it,
 19 18 but by extrapolation, from what it is observed in
 20 19 populations. And knowing that these species or in these
 21 20 lineages that we're watching change, are simply, when
 22 21 broken down, consisting of smaller lineages like we see
 23 22 today, changing like we see today, then it's all of a
 24 23 continuum.
 25 24 Q Okay. And when -- I think my question was
 26 25 imprecise. When we look at what is allowing certain

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 2 1 process that led your mentor to first advance the
 3 2 notion, as a hypotheses, and then, as you put it in suc'
 4 3 a gentlemanly way, to sort of retrack it, when he
 5 4 thought it wasn't tenable. Because that, I think --
 6 5 that will help me get a handle on -- let me get a page
 7 6 here.
 8 7 MR. ROTHSCHILD: Page 13.
 9 8 MR. GILLEN: Thank you.
 10 9 BY MR. GILLEN:
 11 10 Q I'm not interested in the conclusion
 12 11 particularly, or in the -- in any way discrediting your
 13 12 mentor. That's not my point. I just want to see like
 14 13 what, as a way for me to understand the process, the
 15 14 judgements that you're making, you're familiar with this
 16 15 work. What was it that led him to advance that notion
 17 16 that, well, maybe it was a --
 18 17 A Insect net.
 19 18 Q Yeah, insect net. You can say that. I don't
 20 19 want to.
 21 20 A He called it the insect net. It was very
 22 21 funny.
 23 22 He reasoned that the first birds were small,
 24 23 and that they came from small dinosaurs that were
 25 24 carnivorous. Well, if you're small and carnivorous,
 26 25 what can you eat. You can eat little lizards, you can

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 2 1 branches to endure and certain to -- you know, certain
 3 2 to be become extinct, there, as I understand your
 4 3 testimony, we understand that there's this causal
 5 4 connection between the features and the environment and
 6 5 there's some way in which in the features that you're
 7 6 seeing persist through time are conferring an advantage.
 8 7 And as a paleontologist, you're trying to get a line on
 9 8 that advantage.
 10 9 What I'm just trying to get straight, in my
 11 10 mind, is this idea that when you do that, it consists,
 12 11 in you as a paleontologist, looking at a variety of
 13 12 possible explanations for the advantage that could be
 14 13 conferred by the feature you're focused at a given time,
 15 14 and then entertaining a hypothesis in that way; is that
 16 15 true?
 17 16 A Yes.
 18 17 Q And I want to ask. I mean, you have a very
 19 18 interesting comment about your -- one of your mentors, I
 20 19 think, John Ostrom?
 21 20 A Yes.
 22 21 Q And I think you called it, at one point, he had
 23 22 a view, which I understand that you do not agree with
 24 23 the way in which it's been portrayed in Pandas?
 25 24 A Yes.
 26 25 Q What I'm interested, though, just in the

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 2 1 eat baby whatever, but you can certainly eat insects.
 3 2 And an animal the size of a chicken or pigeon running
 4 3 around in the Jurassic is likely to do what such animals
 5 4 of that size do today, which is eat insects.
 6 5 And so -- and he knew from its structure that
 7 6 it's a bipedal animal. It's running around on its back
 8 7 legs. Its forelimbs are free from locomotion. It has
 9 8 relatively long arms. The arms are almost as long as
 10 9 the legs. And it's got very long and prehensile fingers
 11 10 capable of grasping. And if you have feathers, even not
 12 11 very long ones, attached to these fingers, and you were
 13 12 running along trying to catch insects, wouldn't it help
 14 13 you to have big flyswatters on your hands.
 15 14 Now not that there was any direct evidence for
 16 15 such long feathers on the animals, he knew at the time,
 17 16 in fact, there wasn't. Now there is. But his proposal
 18 17 was based on an inference of what he could tell about
 19 18 the probable ecology of the animals that the first birds
 20 19 came from and going from there to a wing with long
 21 20 feathers that could be used in flapping and flying; he
 22 21 proposed that there would be an intermediate stage based
 23 22 on what he would regard as a reasonable guess about its
 24 23 possible function in ecology.
 25 24 As it turned out, a few other scientists were
 26 25 sitting down over, you know, coffee one day, one was an

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 2 1 ornithologist, one was a chemist, one was a physicist,
 3 2 and they started to talk about this. And as people do,
 4 3 you know, scratch notes on a napkin, and these guys
 5 4 said, you know, I've been reading this paper -- which he
 6 5 wrote a popular paper in a scientific magazine --
 7 6 reading this paper, and he said it just doesn't make
 8 7 sense, because if an animal jumped up and grabbed
 9 8 insects like that, it would lose its equilibrium and
 10 9 tumble over. And they showed how that actually was the
 11 10 expected result.
 12 11 Now, they didn't establish or prove that, but
 13 12 they said this would be a problem. They said, instead,
 14 13 if the animal is running along with its hands out to the
 15 14 sides, if it jumps up to grab the insect with its mouth,
 16 15 the proto wings now here are stabilizing the animal and
 17 16 increasing its lift, and maybe that's good in the
 18 17 process and it wouldn't go tumbling head over heels.
 19 18 And John, when he saw this paper, which I
 20 19 remember was sent for review, he said -- he said what do
 21 20 you think about this. And I said, I think they got it
 22 21 right. I think it's really a much more important
 23 22 function in getting aerodynamics than in distracting it
 24 23 for another function, which would really take it off the
 25 24 path of improvement toward flight.
 26 25 And John, who always had his own ideas and was

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1 00099
 2 1 been known for decades to be mainly a problem of fossil
 3 2 preservation?
 4 3 A Yes.
 5 4 Q Now, I just want to get a sense of what that
 6 5 means to you as a paleontologist. What is the problem?
 7 6 A The problem is that we have to read the life of
 8 7 the past from the preserved rocks. The problem is that
 9 8 the longer rocks lay around, the less chance you have of
 10 9 finding what you're looking for. Rocks that are 15
 11 10 million years old are far more likely to be preserved
 12 11 than rocks that are 500 million years old. Lots of
 13 12 things happen in this interim.
 14 13 We have no sea floor older than the Jurassic
 15 14 about 200 million years ago. The reason is, that
 16 15 continental plates keep moving up against each other.
 17 16 And as they hit each other, quite often, one of them is
 18 17 drawn down into the earth beneath the other one. That
 19 18 crust then becomes recycled, melted and lost. This has
 20 19 been going on for so long that we have no sea floor, as
 21 20 I said, older than 200 million years ago, which is not
 22 21 very -- it's only a part of the fossil record.
 23 22 The Cambrian forms we're talking about lived on
 24 23 the ocean floor. So the only place now that we're going
 25 24 to get records of ocean floor older than this is if that
 26 25 ancient ocean was somehow thrust up on the continental

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1 00098
 2 1 a very good reasoner about things, agreed quite readily.
 3 2 And he later wrote in a paper that he published, the
 4 3 insect net hypothesis is dead, it served its purpose.
 5 4 Because he put out a hypothesis that these guys were
 6 5 able to chew on and show the problems with this, but,
 7 6 you know, we've got maybe, if we just adjust it this
 8 7 way, move the prey catching function from the hands to
 9 8 the mouth and use these instead for balance and lift,
 10 9 then we'll get a better result.
 11 10 Q Now, is that -- I admire, too, the openness to
 12 11 the other hypothesis. I mean, that is beautiful.
 13 12 Is this an example of what you called
 14 13 functional morphology?
 15 14 A Yes.
 16 15 Q Okay. Let me just ask you another question
 17 16 about the Cambrian Explosion and the fossil record. In
 18 17 your report, you take issue with Meyer's effort to
 19 18 explain the pre-Cambrian Explosion. And I notice that
 20 19 there you -- in connection with that observation of
 21 20 yours, I think it's on page 16.
 22 21 MR. ROTHSCCHILD: Just for the record, it's just
 23 22 Cambrian Explosion. That's part of the problem.
 24 23 MR. GILLEN: Thank you.
 25 24 BY MR. GILLEN:
 26 25 Q You say there that the Cambrian Explosion has

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1 00100
 2 1 surfaces and preserved, not eroded, but exposed to the
 3 2 surface now so that we can uncover it and find things.
 4 3 You can imagine that the chances of getting a complete
 5 4 record of something as far back as the Cambrian and
 6 5 immediate pre-Cambrian, are very small. We have pieces
 7 6 here and there. Like a book in which you're pulling a
 8 7 bunch of pages out from one chapter, and then skipping
 9 8 20 pages and pulling -- you know all the metaphors.
 10 9 It's the same idea.
 11 10 Q But it is interesting and you are helping me
 12 11 understand.
 13 12 Is it that, therefore, there's various strata
 14 13 in the Cambrian and you -- what's lacking is a piece, so
 15 14 to speak, that allows you to get through the strata that
 16 15 are associated with that period?
 17 16 A Let's say that there are increasingly more gaps
 18 17 in the record, all things considered, the farther back
 19 18 we go. It's as if you had a stack of paper, and from
 20 19 the -- moving from the top, you pulled every other page
 21 20 out, and then as you got farther down, it was every
 22 21 third page, and then every fourth page. By the time you
 23 22 got to the bottom, you'd be taking every twentieth page,
 24 23 and you wouldn't have a very good sense of the
 25 24 continuity of the -- you might -- on those pages, there
 26 25 would be lots of available information. You could,

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1 00101
 2 1 depending on what sort of document you were looking at,
 3 2 connect those pages even though they might be 20 pages
 4 3 apart. Does that help?
 5 4 Q I think so. Are you saying then, Kevin, that
 6 5 the problem of the Cambrian Explosion is that it may
 7 6 appear more explosive than it was simply because we're
 8 7 missing the intermediate strata or pages that would
 9 8 allow you to see a more gradual transition of the kind
 10 9 you see in other periods?
 11 10 A That's a part of it. Yes. That's a big part.
 12 11 And the other part of it is, that there is -- the other
 13 12 part is the question of how to read the pages that are
 14 13 preserved. So in the early Cambrian, the so-called
 15 14 Explosion, is occurring in a five, ten million-year
 16 15 period, which is a lot of time. It's not an instant.
 17 16 And a lot of the major groups of sea animals that we
 18 17 know today are found by the end of that Cambrian
 19 18 Explosion. They don't all appear at once.
 20 19 And there are also indications of those animals
 21 20 before that five to ten million year bracket. In faunas
 22 21 of very small-shelled animals from five million years
 23 22 before that, for example, we have mollusks of various
 24 23 kinds. We have brachiopods. We have other calcite
 25 24 tubes that suggest various kinds of worms or other
 26 25 animals. And some things we just can't really tell that

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1 00103
 2 1 understand you. You've given us now an increasingly
 3 2 longer period of time prior to the pre-Cambrian.
 4 3 A Cambrian.
 5 4 Q Sorry, Cambrian.
 6 5 And the -- in which, if I understand you
 7 6 correctly, you're saying these are precursors to some --
 8 7 or, arguably precursors, to some forms that we see in
 9 8 the Cambrian period; is that accurate?
 10 9 A We conclude that they are members of the
 11 10 metazoans, if very primitive ones. We do not
 12 11 necessarily say that they are the embryos or the tracks
 13 12 of lobsters or clams or anything like that. We simply
 14 13 know them as metazoans in the same way that we have
 15 14 horses and elephants and impala today. But if we went
 16 15 back 50 million years to their ancestors, and looked
 17 16 around North America and Africa, we wouldn't recognize
 18 17 anything like a horse or a springbok or an elephant that
 19 18 we see today. We would see much more archaic-looking
 20 19 animals.
 21 20 Q And then you made a statement to the effect
 22 21 that the presentation of this subject matter was
 23 22 deficient in your judgment. Tell me why, just explain,
 24 23 what is it, you said it's true as far as it went, but
 25 24 you thought it was not the way to explain it to
 26 25 schoolchildren.

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1 00102
 2 1 they have any further relatives.
 3 2 If we go back 20 million years before that, we
 4 3 have the burrows of animals that are progressing along
 5 4 the ocean floor. They're kind of trackways, if you
 6 5 want. And these are just linear wormy type things going
 7 6 along. But we know that those animals must have had a
 8 7 head and they must have had legs or some kind of
 9 8 locomotory ability to go forward.
 10 9 Therefore, they have features of the organisms
 11 10 that we find at the Cambrian Explosion. We call those
 12 11 animals metazoans, which are generally multi-celled
 13 12 animals.
 14 13 If we go back 70 million years before this
 15 14 Cambrian Explosion, we have the remains of embryos.
 16 15 Amazing to find them, but you never know what's going to
 17 16 be preserved. These embryos have complex features that
 18 17 are associated with metazoans. So we know that at least
 19 18 some early members of the metazoans must already have
 20 19 existed 70 million years before the Cambrian Explosion.
 21 20 These facts were ignored in the treatment of
 22 21 the Cambrian Explosion by the Intelligent Design
 23 22 proponents. Was what they said true as far as it went?
 24 23 In part, it probably was. Is this the way to explain a
 25 24 problem like that to schoolchildren? No.
 26 25 Q When you say that, Kevin, let me just

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1 00104
 2 1 A I think without including evidence of the small
 3 2 shelly faunas of the bilateral trace fossils, and of the
 4 3 ancient embryos, you are pretending that all this change
 5 4 is happening in a much briefer window than it actually
 6 5 appeared in. And I don't know why someone would want to
 7 6 do that.
 8 7 Q So you -- in other words, it -- how should we
 9 8 say -- it exaggerates, in your judgement, the sense of
 10 9 explosion by failing to trace back to these precursor
 11 10 forms?
 12 11 A By leaving out all of the important information
 13 12 that could relate to a more distant genealogy.
 14 13 Q Okay. And that's what I'm trying to get at.
 15 14 You say this earlier information that could relate to a
 16 15 more distant -- did you say genealogy?
 17 16 A I did.
 18 17 Q Okay. Is it -- is the view that you described,
 19 18 is that an accepted view in paleontology?
 20 19 A Yes.
 21 20 Q And so, therefore, is it -- I just, again, want
 22 21 to make sure your objection is that it seems this
 23 22 treatment in Pandas is -- has an artificial temporal
 24 23 boundary imposed on this examination of connections?
 25 24 A Yes.
 26 25 Q Okay. On page 15, Kevin, you are speaking, at

Kevin Padian

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1 00105
 2 1 the top of that sentence beginning at the top, to the
 3 2 fossil record, and the way in it's inductive. And you
 4 3 say there, "We" -- I believe you're referring to your
 5 4 profession community of paleontologists -- "derive
 6 5 general inferences based on countless examples, which
 7 6 present us with repeatedly tested and confirmed patterns
 8 7 from which the history of life is reconstructed."
 9 8 And then you go on further. I just want to
 10 9 understand, is that -- is that statement there, a
 11 10 reference to what we've discussed this morning.
 12 11 A Every time we go in the field and find a new
 13 12 specimen, it provides another -- we would say datum,
 14 13 singular of data -- point. Another piece of information
 15 14 that tests our ideas about what we think we know of
 16 15 the -- of the pattern of life through time. If I was
 17 16 working in Cambrian strata and let's say I found a horse
 18 17 tooth, that would be a little unusual. We don't know if
 19 18 horses anywhere back that far. And immediately, of
 20 19 course, we would want to see whether this was a correct
 21 20 identification, whether it was something that washed in
 22 21 from another place, whether -- any other possibilities.
 23 22 But we don't find those things.
 24 23 When we go out, we find the usual trilobites
 25 24 and ancient snails and other sea creatures that lived
 26 25 then on the ocean floor. They don't really jar our

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1 00106
 2 1 understanding. And that's what I mean by being
 3 2 confirmed by countless examples. Every time we go out
 4 3 to do this, we're actually testing our whole theory of
 5 4 the fossil record.
 6 5 Q Now, I do have a better understanding at what
 7 6 you're getting at.
 8 7 So in other words, you're -- there's a
 9 8 consistent yield from a consistent period or -- how
 10 9 would you describe it? There's a consistent yield of
 11 10 similar fossils from a rock sample that's associated
 12 11 with that period. Is that what you're getting at?
 13 12 A We keep getting the same signals, that's right.
 14 13 Q Now, just to go -- you go on there. These
 15 14 patterns -- and that's what we're talking about -- and
 16 15 the processes inferred to produce them. Now, when you
 17 16 say that, Kevin, what are you getting at there? The
 18 17 process inferred to produce them?
 19 18 A The processes of evolutionarily change we've
 20 19 talked about.
 21 20 Q All right. "Are in turn based on conventional
 22 21 scientific methods."
 23 22 What are you getting at there?
 24 23 A That when our methods can range from anything
 25 24 from the rigors of typical and correct field collecting
 26 25 to the rigors of correct identification of specimens,

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1 00107
 2 1 their classification. The correct identification of the
 3 2 type and age of the rock we're looking at, the
 4 3 reconstruction of their environment, such things like
 5 4 that.
 6 5 Q Okay. So now, are those methods that you've
 7 6 described, are they dating methods or are they dating
 8 7 and morphology comparisons, how would you --
 9 8 A They are dating -- they're situating in time
 10 9 and space. And relating those to other data we have of
 11 10 organisms we have in time and space.
 12 11 Q The dating or situating in time and space, as
 13 12 you described it, what exactly is that? Is that
 14 13 comparing this find against what we know what the
 15 14 discipline holds today about geologic time and geologic,
 16 15 I guess, strata?
 17 16 A Yes. Which, in turn, is based not only on
 18 17 geology, but on the principles of physics and chemistry,
 19 18 and so forth, which allow us to put what we call
 20 19 absolute dates on ancient rocks.
 21 20 Q Okay.
 22 21 A Paleontologists and geologists, just in the
 23 22 field, can look at different rock outcrops and say this
 24 23 one is higher or lower than the other. That's basically
 25 24 the way the whole geologic rock column is established,
 26 25 but no one knew exactly how old these rocks were. That

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1 00108
 2 1 depended on isotopic dating that was based on the
 3 2 understanding of radioisotopes that came directly from
 4 3 physics and chemistry, having nothing to do with
 5 4 paleontology, biology or evolution.
 6 5 Q And then, you've also indicated that another
 7 6 element of this -- of the method, the method of
 8 7 paleontology is the morphology -- the classification?
 9 8 A Yes.
 10 9 Q Is that what we discussed earlier today?
 11 10 A With that funny word, synapomorphies,
 12 11 everything associated with it. Now we classify
 13 12 organisms in the tree of life, yeah.
 14 13 MR. GILLEN: Let me ask Ana to mark this as
 15 14 Exhibit 2.
 16 15 (Defendant's Exhibit 2 was
 17 16 marked for identification.)
 18 17 BY MR. GILLEN:
 19 18 Q I know, Kevin, I just want to get some
 20 19 additional detail on your notion that -- whether you
 21 20 have an opinion concerning whether Intelligent Design
 22 21 Theory or Intelligent Design Creationism, as you call
 23 22 it, is a science properly -- considered as a science.
 24 23 Do you have an opinion on that?
 25 24 A My understanding of Intelligent Design is that
 26 25 it does not qualify as science.

Kevin Padian

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1 00109
 2 1 Q It does not qualify as science?
 3 2 A Right.
 4 3 Q Okay. Now, if -- I want to ask, if you look at
 5 4 page 15, and you have a conclusion there that the order
 6 5 of appearance of the major groups of plants and animals
 7 6 records with the expectations and patterns of the
 8 7 evidence and theory of contemporary evolutionarily
 9 8 biology. Is that what we've discussed today, the way in
 10 9 which the findings of paleontology support
 11 10 evolutionarily and biology, as you understand it?
 12 11 A Yes.
 13 12 Q Okay. Now, you have an opinion that
 14 13 Intelligent Design is not science; correct?
 15 14 A Yes.
 16 15 Q Just tell me why.
 17 16 A I guess it would be more appropriate to ask why
 18 17 it is science. It makes no predictions that have been
 19 18 tested empirically. It has not shown that existing
 20 19 understanding is so insufficient as to warrant a
 21 20 completely different and supernatural explanation of
 22 21 patterns and processes of life. It has not ever been
 23 22 presented as science to the scientific community, which
 24 23 means that it has no standing as science in the
 25 24 scientific community. And it's difficult to see what
 26 25 would make its proponents give up its major

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1 00110
 2 1 stipulations.
 3 2 For example, if someone were to claim that a
 4 3 particular structure was so complex that it couldn't
 5 4 possibly have evolved through intermediate steps, but
 6 5 must have been created by a designer of some
 7 6 intelligence and presumably, supernatural features, if
 8 7 we then found features that -- in fossil animals, for
 9 8 example, that were, for all intents and purposes, to a
 10 9 reasonable qualified investigator, intermediate in
 11 10 structure, and could explain the transition of form and
 12 11 function, would that then falsify the claim that there
 13 12 was a designer. If it would, then I think we're getting
 14 13 out of the realm of science. And if it wouldn't, then
 15 14 the proposition would essentially be unfalsifying it and
 16 15 it still wouldn't be science.
 17 16 Q So let me before we -- I try to understand
 18 17 that. Let me just make sure I got the reservations you
 19 18 have down. Seems like, no predictions that can be test
 20 19 empirically, you mentioned?
 21 20 A No predictions that have been tested
 22 21 empirically, as far as I know.
 23 22 Q Okay. It hasn't, as a theory, managed to
 24 23 produce a sufficiently powerful criticism of other
 25 24 theories to warrant displacing existing theories?
 26 25 A But criticism of one theory is not support for

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1 00111
 2 1 another.
 3 2 Q Right, and I do understand that.
 4 3 Am I understanding you, that's part of what
 5 4 gives you the sense that -- in other words, I see what
 6 5 you're saying. Even if they could mount a criticism of
 7 6 evolutionarily biology, that wouldn't necessarily make
 8 7 the case for Intelligent Design. Is that your point
 9 8 there?
 10 9 A And I wonder if a criticism of evolution in
 11 10 biology is even necessary to posit Intelligent Design.
 12 11 Why can't there be a designer who works entirely
 13 12 according to natural processes, with no miraculous
 14 13 interventions? Why does this have to depend on
 15 14 criticism of evolutionarily theory, as we understand it?
 16 15 Q Is that your understanding of the position held
 17 16 by Intelligent Design proponents?
 18 17 A Insofar as Intelligent Design holds, in
 19 18 general, that -- that certain structures or certain
 20 19 phenomena in evolution could not have evolved, but must
 21 20 have been especially created by a designer. And insofar
 22 21 as the mechanisms that are posed to enable us to
 23 22 recognize this, includes such things as irreducible
 24 23 complexity and specified complexity, yes.
 25 24 Q Okay. Now, is it your understanding that those
 26 25 concepts you've referenced, Irreducible Complexity and

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1 00112
 2 1 then Specified Complexity, are not falsifiable?
 3 2 A Insofar as they recur to a causal mechanism of
 4 3 an Intelligent Designer, yes.
 5 4 Q And just why do you say that?
 6 5 A Because if structures are Irreducible
 7 6 Complexity, they cannot have evolved and must have been
 8 7 specially created. That creation must be by the
 9 8 intervention of some kind of -- of Supernatural Power,
 10 9 because it is not being discussed in natural terms.
 11 10 Q When -- now earlier, you were mentioning that
 12 11 you didn't see why criticism of evolutionarily biology
 13 12 had to be sort of a feature of Intelligent Design
 14 13 Theory. And I believe you noted that there's a
 15 14 possibility there could be a designer operating in
 16 15 natural ways; is that correct?
 17 16 A Sure.
 18 17 Q Now, is that -- that thesis, if you call it
 19 18 that, do you have an understanding concerning whether
 20 19 that is consistent with Intelligent Design Theory?
 21 20 A My understanding is that IDC goes farther in
 22 21 stipulating that no natural processes cannot account for
 23 22 this and, therefore, we must look for science of a
 24 23 Creative Intelligence that is beyond the natural
 25 24 processes we know.
 26 25 MR. GILLEN: IDC is short for Intelligent

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1 Design Creationism, the term used in Kevin's expert report to refer to what I have described as Intelligent Design Theory, just for the record.

BY MR. GILLEN:

Would you have a different opinion about Intelligent Design Theory, Kevin, if the notion of change occurring through natural processes was a part of Intelligent Design Theory?

MR. ROTHSCHILD: Objection, different opinion.

BY MR. GILLEN:

Q As to whether or not it was science?

A We would determine whether that part of it, the Intelligent Design part, was science by virtue of whether it had any consequences that could be empirically assessed. That is, with reference to phenomena in the natural world.

Q Okay. I'm having a hard time understanding what you're getting at there. Can you?

A Science is based on empirical evidence of the natural world. If someone wants to claim the existence of any sort of forces that are not natural, they may do so, but science has no regard. It's not in science's purview to talk about those things. If that's fair enough to say.

If -- for example, let's say most people or a

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1 intervention by some supernatural cause?

A Yes. In that sense, ID becomes a science.

What we call a science stopper. There is no reason to investigate this further because we have determined this is too complex to evolve. And therefore, some Creative Intelligence must be at work.

What worries me is, when they find out in any number of cases after having said that, that they're wrong, what happens to the theory? And even if you have a theory, do you have any cases where you can absolutely say this could not have evolved in any natural way.

Q Well, let me ask you, if this notion of intermittent intervention, in what you describe or perceive as a natural processes, were not a necessary ingredient in Intelligent Design Theory, would it then qualify as science, in your judgement?

A It would -- if you remove notions of Irreducible Complexity and Specified Complexity, which are -- I think, it's fair to say are the only two postulated potential hallmarks by which Intelligent Design could be justified, then you have left only the supernatural belief.

Q So let me understand you. Are you saying that these two concepts, Irreducible Complexity and Specified Complexity, are necessarily connected with the notion of

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1 great number of people accept the existence of God, accept that God set up the universe, accept that God, or whatever superior being or beings or entity, or however you wish to describe or talk about it, put in motion natural processes that resulted in everything we see around us, and I think that's the mainstream view in religion, would not have to tamper all the time with these things, miraculously, to put flagella on bacteria, wings on birds, and flippers on whales; you might say that it would be very hard to recognize the effects of the Supernatural Being like that. And we would all agree.

So on the other hand, it doesn't stop us from examining the appearance and the processes that are in the world around us.

Q That's what I'm trying to understand, Kevin. It is the notion of, shall we say, intermittent intervention, which you've referenced a few times here? Is that -- I take it, that's a notion that you've associated with Intelligent Design Theory?

A Yes.

Q And is it that which is the basis why you're saying it's not science, because rather than look at natural processes, as you described them, it's sort of just positing, as you understand it, at intermittent

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1 intermediate intervention by supernatural forces?

A I believe they have been associated with it by people like Dembski and Behe. Because it isn't their writings that we find the corpus of the approach to the empirical world that is not simply the Intelligent Design theology part that would go back to William Paley in the late 1700s.

Q So is it your opinion that Intelligent Design cannot qualify as science because it is positing this intermittent intervention by a non-natural process, as you understand it, is that the --

A It does not qualify because it hasn't shown this in any substantive respect.

Q When you say, "it hasn't shown this," you mean what?

A I mean that no one has provided any evidence for a case where something couldn't have evolved and must have been produced, therefore, by some divine or Creative Intelligence that is not using natural means that we understand.

Q Okay. Let me make just sure I understand. So you're saying that so far none of the proponents of Irreducible Complexity or Specified Complexity had actually produced a case, which in your judgment, cannot be accounted for by purely natural processes. And,

Kevin Padian

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1 00117
 2 1 therefore, you do not see the concepts of Irreducible
 3 2 Complexity or Specified Complexity as capable or as yet,
 4 3 demonstrated empirically?
 5 4 A Yes. For example, what is written in Pandas
 6 5 about the problems of intermediate changes between birds
 7 6 and whatever reptiles they descended from, even when
 8 7 they wrote this, there was far better evidence than they
 9 8 had to show how those transitions could have taken
 10 9 place.
 11 10 Now, in the last ten years with the evidence of
 12 11 the feathered dinosaurs from China, we've learned so
 13 12 much more about those transitions, that it's generally
 14 13 accepted. Not simply by the scientists that work on
 15 14 that, but by reporters, by textbook writers, by -- this
 16 15 is the consensus conclusion that's understood in the
 17 16 world of science.
 18 17 Now, these guys who wrote Pandas 15 years ago
 19 18 ought to be going, whoa, we blew that one. Which is
 20 19 what scientists say to each other all time, because
 21 20 we -- this is -- but it's a case of where nothing has
 22 21 been shown and accepted by the scientific community to
 23 22 require an explanation of Intelligent Design. And so
 24 23 the question is, if this has not qualified as science,
 25 24 why are we teaching it as science, why are we giving it
 26 25 pride and place in science curriculum. I would think

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1 00119
 2 1 scientific investigation.
 3 2 Q Do you have any understanding concerning
 4 3 whether people who, you know, endorse, in some measure,
 5 4 Intelligent Science Theory, are engaged in science?
 6 5 A Some of them may be engaged in some types of
 7 6 science. I am not yet persuaded that any of that really
 8 7 bears on Intelligent Designs, because if it did, we
 9 8 would expect to see scientific publications in peer
 10 9 review journals that essentially test hypotheses about
 11 10 Intelligent Design in particular cases.
 12 11 Q To your knowledge, I take it, there are none?
 13 12 A To my knowledge, there are none.
 14 13 Q You've mentioned this notion of testable
 15 14 several times. I want to get a better sense what you
 16 15 mean by that, "testable." Now -- I mean, in what sense
 17 16 is Intelligent Design not testable?
 18 17 A If you have an idea that something was whatever
 19 18 intelligently design means, and its proponents are not
 20 19 particularly specific on that point when they're
 21 20 discoursing in venues related to science or education,
 22 21 when you hypothesize something as being intelligently
 23 22 designed, what would be the test of figuring that out.
 24 23 So far, we don't have any tests. Now would we know that
 25 24 a structure was intelligently designed?
 26 25 Q Well, that's what I'm trying to get. How you

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1 00118
 2 1 that you would want to have notions that are really
 3 2 thoroughly tested, accepted by scientific consensus and
 4 3 then put into curriculum textbooks, which is the way we
 5 4 do all the rest of the things we've talked with.
 6 5 Q So -- all right. I want to understand.
 7 6 You say it doesn't qualify as science and you
 8 7 pointed to, I think, the fact that, so far as you can
 9 8 tell, there's been no case made for an organism or
 10 9 structure that is irreducibly complex, right?
 11 10 A Correct.
 12 11 Q Second, you've said here that it hasn't been
 13 12 presented to the scientific community and accepted as
 14 13 science?
 15 14 A Correct.
 16 15 Q Is that, in your judgement, sort of another
 17 16 hallmark of science, or what it takes to qualify as
 18 17 science?
 19 18 A Yes.
 20 19 Q You said that it's -- Intelligent Design is a
 21 20 "science stopper"?
 22 21 A Yes.
 23 22 Q What do you mean by that?
 24 23 A Once someone says that, well, God did it this
 25 24 way or the equivalent, and there's nothing else we can
 26 25 investigate about it, that seems to hold all further

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1 00120
 2 1 approach this. If we look at -- there's two concepts
 3 2 here, I know, that you take issue with, Irreducible
 4 3 Complexity and Specified Complexity. Now, it's my
 5 4 understanding that those are efforts to test the concept
 6 5 of Intelligent Design.
 7 6 A They are suggestions, but to qualify as
 8 7 scientific tests, they need to be presented to the
 9 8 scientific community as peer review propositions so that
 10 9 the scientific community could say, hum, yes, well, we
 11 10 agree that if we found such structures or such
 12 11 conditions, we would agree with this; however, that has
 13 12 not been done. Neither proposition has been subjected
 14 13 for scientific peer review. In fact, as I understand,
 15 14 that both -- both ideas have been rejected by the
 16 15 proponents Behe and Dembski for submission for
 17 16 scientific peer review, they're not interested in this.
 18 17 Q Let me just understand. In other words, now,
 19 18 it seems like you're saying, well, intelligent -- let's
 20 19 say, Irreducible Complexity or Specified Complexity have
 21 20 been proposed as tests, but they haven't gone to the
 22 21 next level, which is accepted as tests by the scientific
 23 22 community?
 24 23 MR. ROTHSCHILD: Objection, mischaracterizes
 25 24 his testimony.
 26 25 BY MR. GILLEN:

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1 00121
 2 1 Q I'm just trying to understand.
 3 2 A I can put it in my own words.
 4 3 Q Oh, yes, certainly.
 5 4 A So they -- Behe and Dembski may have written
 6 5 about this in popular books and vehicles.
 7 6 Q Right.
 8 7 A That doesn't qualify as the business of
 9 8 science. If they want to be taken seriously, they have
 10 9 to do what everybody else does. And what Behe, at least
 11 10 as a biochemist does, in his own more quotidian, for
 12 11 want of a better word, biochemical work, like
 13 12 microquodidian paleontological work, going out and
 14 13 describing a new species of anything from a rock is what
 15 14 we do every day. It's reconstructing the phone book of
 16 15 life.
 17 16 And, you know, someone like Behe, in his
 18 17 ordinary biochemical work, would submit that for peer
 19 18 review. Here you have an idea that he thinks is the
 20 19 most colossal idea of his scientific career. Why is it
 21 20 that he hasn't submitted this to peer review? Why
 22 21 aren't we reading about this from him in the pages of
 23 22 the most renowned scientific journals? Why aren't the
 24 23 noble people beating the path to his door, and other
 25 24 people, to award him prizes for this, for
 26 25 re-revolutionizing our understanding of a huge central

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1 00122
 2 1 scientific concept? Why are they not even trying?
 3 2 Q Okay. So let me just look back. I'm looking
 4 3 at this -- why you have this opinion that Intelligent
 5 4 Design theory is not a scientific theory. And we're
 6 5 talking about the testability, and then this other
 7 6 aspect of scientific, including the sort of communal
 8 7 element of it, the peer review process. I -- so in
 9 8 terms of the testability, as I say, it's my
 10 9 understanding that Behe, through the concept of
 11 10 Irreducible Complexity, and Dembski, through the concept
 12 11 of Specified Complexity, are attempting to create
 13 12 criteria that would test the idea of Intelligent Design
 14 13 against which that idea can be tested. Do you agree
 15 14 with that?
 16 15 A I agree that they are talking about this to
 17 16 sympathetic audiences.
 18 17 Q Okay.
 19 18 A I do not agree that they are proposing it as
 20 19 science.
 21 20 Q Okay. Now, in terms of looking at the testing
 22 21 function, do you agree that they have at least presented
 23 22 these as tests of their theory?
 24 23 A No. I agree that they have talked about them
 25 24 in nonprofessional venues. And I'm not sure that --
 26 25 forgive me, I would dignify it by calling it proposed.

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1 00123
 2 1 I could -- to reduce it to the absurd, I could say,
 3 2 look, I can flip this coin and if it comes up heads,
 4 3 then this proposition should be accepted. Now, of
 5 4 course, that's stupid and no one would ever do that, but
 6 5 I do not see people falling all over each other to look
 7 6 at what Behe and Dembski have proposed and saying, even
 8 7 in an informal recognition sense, hey, these are really
 9 8 good ideas. In fact, the informal criticism, their
 10 9 informal ideas, has been legion. I'm not seeing anyone
 11 10 in these communities, as a whole, pick this up and say,
 12 11 hey, we got to hear more from these guys. Why wouldn't
 13 12 that be happening if this was a good idea?
 14 13 Q And I do understand what you're getting at.
 15 14 I'm just trying to look at these two features and get a
 16 15 fix on your understanding for Intelligent Design Theory.
 17 16 Your last response, I take your point, which, as I
 18 17 understand it, is that, well, present maybe, it may be
 19 18 presented, but not presented to the relevant -- the
 20 19 people it should be presented to?
 21 20 A In a certain way.
 22 21 Q Okay. So I want to make sure I understand you.
 23 22 They have offered Irreducible Complexity as a test of
 24 23 Intelligent Design Theory. That, at least, is something
 25 24 you agree with? Yes or no?
 26 25 MR. ROTHSCHILD: Objection. I'm not sure

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1 00124
 2 1 what -- you used hand quote marks. I'm not sure what
 3 2 that was supposed to convey, but it won't be on the
 4 3 record.
 5 4 THE WITNESS: Could you say that again?
 6 5 BY MR. GILLEN:
 7 6 Q Sure, no problem. Kevin, I want to get to the
 8 7 nub of this. You've got a basis for an opinion that
 9 8 it's not science. I understand that. I'm just trying
 10 9 to figure out where there's a disconnect here. And one
 11 10 of the things that I understand is that there are
 12 11 proponents of Intelligent Design Theory, and they, at
 13 12 least I'm told, are trying to create the test of
 14 13 Intelligent Design by pointing to criteria, which would
 15 14 identify Intelligent Design. It's my understanding that
 16 15 that's why Behe advances the notion of Irreducible
 17 16 Complexity to make his thesis testable.
 18 17 MR. ROTHSCHILD: Objection, again. You used
 19 18 the word "test" in hand motions of quote marks, and I
 20 19 don't know what that's meant to convey, but it's not on
 21 20 the written record unless I say something.
 22 21 BY MR. GILLEN:
 23 22 Q Do you share that understanding, Kevin?
 24 23 A No, I don't. I think that it doesn't qualify
 25 24 for science for two reasons. First of all, the posits
 26 25 of supernatural agents, which are beyond the reach of

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1 00125
 2 1 science. And second, because although they may have
 3 2 talked about these things and published them informally,
 4 3 they have not subjected their proposed tests to
 5 4 scientific peer review. So it is not science, even in
 6 5 it's potential -- potentially testable features.
 7 6 Q Okay. Maybe I'm understanding you better.
 8 7 That it's -- in order to qualify as science, in your
 9 8 opinion, it not only has to have a criteria by which it
 10 9 can be tested, but that criteria has to be accepted
 11 10 through peer review process?
 12 11 A And the criteria have to be accepted through
 13 12 the peer review process. Also, and another important
 14 13 component, to the extent that this idea involves
 15 14 supernatural agents, it is no longer the purview of
 16 15 science.
 17 16 Q And I think I understand you there, but I want
 18 17 to make sure that I do. When you say "supernatural
 19 18 agents," what are you referring to there, exactly?
 20 19 A Causes, mechanisms, processes and influences,
 21 20 that are not part of the normal behavior of the natural
 22 21 world as we know it. Things that suspend or override
 23 22 those processes or disrupt them or otherwise influence
 24 23 them in extraordinary ways.
 25 24 Q Outside of the ordinary laws of nature, as we
 26 25 know them?

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1 00126
 2 1 A Yes.
 3 2 Q Okay. Is it your opinion that Irreducible
 4 3 Complexity is not a valid scientific concept?
 5 4 MR. ROTHSCHILD: Objection to the form. Do we
 6 5 have a working understanding of Irreducible Complexity
 7 6 for purposes of this question?
 8 7 MR. GILLEN: It's in his report.
 9 8 THE WITNESS: If you take a structure that
 10 9 performs a complex function, and remove some of its
 11 10 parts and it no longer works, then you can say, well,
 12 11 it's Irreducible Complexity. That's not the same as
 13 12 saying that it couldn't possibly have evolved. And yet,
 14 13 Irreducible Complexity says that it could not have
 15 14 evolved. That is Behe's notion of Irreducible
 16 15 Complexity. He states explicitly that this could not
 17 16 have evolved by natural processes that biologists
 18 17 recognize.
 19 18 Q In your opinion, I take it, Kevin, that he
 20 19 is -- that is not the case, that is not true what he
 21 20 posits?
 22 21 A I think he's going beyond the pale.
 23 22 Q Okay. And exactly in what way?
 24 23 A Because we do not know, or cannot imagine, a
 25 24 natural way to get from point A to point B, does that
 26 25 mean, therefore, that we will not discover it, cannot

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1 00127
 2 1 discover it, or that it could not have happened. Behe
 3 2 is saying yes to all three. Scientists would say we
 4 3 can't say that.
 5 4 Q So is it -- is it your understanding that
 6 5 Behe's concept of Irreducible Complexity is not
 7 6 scientific because it necessarily entails positing the
 8 7 unintelligibility of a mechanism of creation or change?
 9 8 MR. ROTHSCHILD: Objection.
 10 9 THE WITNESS: It's positing the impossibility
 11 10 of a change by natural means alone.
 12 11 BY MR. GILLEN:
 13 12 Q And by that, Kevin, do you mean that he has not
 14 13 proven anything is irreducibly complex?
 15 14 A He certainly has not proven or shown that
 16 15 anything is irreducibly complex, that's true.
 17 16 Q Okay. But is that why you're saying here that
 18 17 it's not a scientific concept because it's -- he's
 19 18 failed in his proof or because the idea is flawed, which
 20 19 is it? I'm having a hard time following you.
 21 20 MR. ROTHSCHILD: Objection.
 22 21 THE WITNESS: It's because when you stop
 23 22 inquiry by saying that it is no longer possible to
 24 23 search for natural means to explain A to B, you are
 25 24 effectively removing the inquiry from the domain of
 26 25 science. And I'm not sure you can be that peremptory

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1 00128
 2 1 about the cases that have been exemplified or that would
 3 2 be presented to students in school through things like
 4 3 Pandas.
 5 4 Q That's what I'm trying to get at. Is it that
 6 5 you think there is the concept of Irreducible Complexity
 7 6 hasn't been demonstrated scientifically so that it
 8 7 cannot be presented as a scientific concept?
 9 8 A That's part of it, yes.
 10 9 MR. ROTHSCHILD: Can I have a standing
 11 10 objection? Because you've asked a lot of questions
 12 11 where you take a current proposition that is the subject
 13 12 of discussion and characterize it as the reason. And I
 14 13 think Kevin has repeatedly said multiple reasons, as he
 15 14 just pointed out. I just want to make sure that the
 16 15 record reflects that when you're focusing on a singular
 17 16 reason, that it doesn't -- is not treated as a
 18 17 contradiction of his earlier explanation that there are
 19 18 multiple reasons why these concepts are not scientific.
 20 19 MR. GILLEN: That's fine.
 21 20 BY MR. GILLEN:
 22 21 Q Forgive me if I'm struggling with this, but I'm
 23 22 trying to understand, Kevin, why, you know, you have
 24 23 this judgement that it's not a scientific proposal here
 25 24 that's being offered. And I'm having a hard time
 26 25 getting a fix on exactly what is setting it off in your

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1 00129
 2 1 mind as not -- an effort to do science?
 3 2 A First of all, nothing has been shown.
 4 3 Q Okay.
 5 4 A Nothing has been subjected to peer review. And
 6 5 the idea entails supernatural agents that cannot be
 7 6 examined by recourse to natural means. For those three
 8 7 reasons, it's not science.
 9 8 Q Do you have the same three objections to
 10 9 Specified Complexity?
 11 10 A Yes.
 12 11 Q Any additional objections to Specified
 13 12 Complexity?
 14 13 A Can't think of any at the moment, but those are
 15 14 strong enough.
 16 15 Q I understand. Are there -- do you have any
 17 16 opinion concerning the specific deficiencies in the
 18 17 concept of Irreducible Complexity as a test for
 19 18 Intelligent Design?
 20 19 A Yes. One of the things that Behe appears
 21 20 repeatedly to reject is a very well accepted
 22 21 evolutionarily understanding that the form and function
 23 22 of one organism can change into a different form and a
 24 23 different function of the same structure in another
 25 24 organism. We call that -- another funny word --
 26 25 exaptation, e-x-a-p-t-a-t-i-o-n. And exaptation is when

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1 00131
 2 1 A Exaptation.
 3 2 Q -- exaptation?
 4 3 A Yes. The simplest form of the feather, even in
 5 4 its hair-like filamentous form, shows us that it had to
 6 5 be important in insulation. Well, feathers are still
 7 6 important in insulation. But they also enable birds to
 8 7 fly.
 9 8 Q So is it your opinion, Kevin, that Irreducible
 10 9 Complexity is not tenable as a test of Intelligent
 11 10 Design because of the possibility of exaptation?
 12 11 MR. POTTSCHILD: Objection.
 13 12 THE WITNESS: I'm only saying that Behe has
 14 13 not -- has not taken into account the ubiquity of
 15 14 exaptation in explaining complex structures and
 16 15 functions.
 17 16 Q And that ubiquity, did you mention it as an
 18 17 evidence in paleontology, is it evidence in the fossil
 19 18 record?
 20 19 A Yes.
 21 20 Q Is there a biological or microbiological
 22 21 account for processes of exaptation?
 23 22 A In fact, if you want to talk about feathers, it
 24 23 turns out that the development of the feather, that is
 25 24 how it develops from a single little placket on the skin
 26 25 into a plume with vanes and barbs and barbules, and all

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1 00130
 2 1 a structure that is being used for one function becomes
 3 2 co-opted for a second function. Usually, even while
 4 3 it's performing -- continuing to perform the first
 5 4 function. And through time, this second function takes
 6 5 on more importance. Maybe the first function is never
 7 6 entirely lost, but now the second function becomes much
 8 7 more important. And therefore, the whole thing has
 9 8 changed.
 10 9 And Behe, in his description of such processes,
 11 10 seems to take this second new form and function and say
 12 11 that you cannot take parts away from it without having
 13 12 it fail its function and that, therefore, it could not
 14 13 have evolved. But he repeatedly overlooks the
 15 14 possibility in the vast literature from the
 16 15 paleontological record, for example, showing that we do
 17 16 see transitions in form and function to very complex
 18 17 things that we don't think evolved out of nothing, but
 19 18 rather, switched their form and function through
 20 19 lineages. We have a number of examples of these things.
 21 20 And it's -- it's frustrating to many
 22 21 biologists, as you'll learn from Ken Miller and other
 23 22 people, that these criticisms incredibly basic and fatal
 24 23 criticisms of his idea, have not been addressed by him.
 25 24 Q Is the process that you've outlined for the
 26 25 precursor to the feather, is that an example of ex --

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1 00132
 2 1 these wonderful structures, that this is essentially
 3 2 mirrored in the development of the feather; that is to
 4 3 say, the evolution of feathers as we see them in the
 5 4 fossil record is, to a great extent, mirrored by the
 6 5 development of the feather on a bird today. And these
 7 6 feathers -- what makes these feathers form and how they
 8 7 open up and form on their axis and bifurcate, and do
 9 8 all these things, the genes that control this now are
 10 9 very largely known.
 11 10 I believe I referred to a paper or several
 12 11 papers in my report by Rick Prum, Prum and Williamsen,
 13 12 Prum and Brush, and some of their colleagues, in which
 14 13 then explained these things quite nicely. And there's
 15 14 an example where the genes really do tell us how these
 16 15 structures came to be the way they are, what genes
 17 16 actually control this.
 18 17 Q How about Specified Complexity? Does -- I
 19 18 mean, it seems to me that that -- does that effort to
 20 19 create a test for Intelligent Design, does that fail
 21 20 because of exaptation?
 22 21 A No. It fails because it uses a completely
 23 22 inappropriate model of evolution as we understand it.
 24 23 Q And is that the probability calculus that you
 25 24 reference in your expert report?
 26 25 A Yes.

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1 00133

2 1 Q And you see that as a fatal, sort of

3 2 methodological flaw in positing the evolutionarily

4 3 probabilities?

5 4 A Because it doesn't describe the process of

6 5 evolution as we know it.

7 6 Q When you say that, are you referencing the

8 7 portion of your report that talks to the way in which

9 8 the certain changes are maintained in the genes?

10 9 A Yes.

11 10 Q Such that the probabilities are -- it's not

12 11 starting over each time?

13 12 A Correct.

14 13 MR. ROTHSCHILD: Does anybody need a break

15 14 here?

16 15 (Recess.)

17 16 BY MR. GILLEN:

18 17 Q Kevin, I've marked something here -- what is

19 18 it, it's two; isn't it?

20 19 A Two.

21 20 Q All right. And I'd ask you, if you would, to

22 21 look at couple of indented --

23 22 A Yes.

24 23 Q -- paragraphs there.

25 24 And particularly, the indented paragraphs that

26 25 begin at the bottom of the first page and carry over,

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1 00135

2 1 A By theory -- and if we can, I think --

3 2 Q It's there, I believe.

4 3 A Yes. "A theory is defined as a well-tested

5 4 explanation that unifies a broad range of observations."

6 5 Q Okay. Do you accept that definition of theory

7 6 as a plausible working definition of the term?

8 7 A It's a good general definition of a theory in

9 8 science.

10 9 Q Okay. And you've expressed an opinion that

11 10 Intelligent Design Theory is not a theory at all?

12 11 A Right.

13 12 Q Explain why you have that opinion, Kevin.

14 13 A First of all, it's not tested. Second of all,

15 14 it doesn't explain anything. And third, it does not

16 15 unify a broad range of observations.

17 16 MR. ROTHSCHILD: Just for the record, the

18 17 definition that's being referred to is actually in the

19 18 document, Exhibit 2, and is on the bottom paragraph of

20 19 page 1 of that document, part of the statement read to

21 20 students.

22 21 BY MR. GILLEN:

23 22 Q All right. If you look at those four

24 23 paragraphs that start at the bottom of the first page of

25 24 Exhibit 2 and carry over.

26 25 I'm going to represent to you, for the purposes

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1 00134

2 1 four indented paragraphs.

3 2 A The first paragraph is pretty funny. Just

4 3 because it's says it identifies Intelligent Design as

5 4 another theory of evolution. That's complete nonsense.

6 5 That simply doesn't compute. It wouldn't be

7 6 identifiable as that to any scientist. It has

8 7 absolutely no track record. It's not on the table as

9 8 something scientific, let alone a theory, which is the

10 9 strongest construct in science.

11 10 MR. ROTHSCHILD: Kevin, can you just be clear

12 11 about which paragraph you're talking about?

13 12 THE WITNESS: This is the one about the biology

14 13 curriculum, and it's also been updated. And the

15 14 paragraph begins, "Students will be made aware of

16 15 gaps/problems in Darwin's theory," et cetera.

17 16 BY MR. GILLEN:

18 17 Q Okay. So -- and there, Kevin, if I understand

19 18 you, you're basically saying Intelligent Design Theory,

20 19 as you know it, is not a theory of evolution?

21 20 A It's not a theory at all. It's not a

22 21 scientific theory at all. And it's certainly not --

23 22 doesn't have any standing as a -- as any concept in

24 23 evolution. It's a concept of antievolution.

25 24 Q And then when you say, "It's not a scientific

26 25 theory at all," what do you mean by that?

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1 00136

2 1 of the deposition, that this is the statement you

3 2 referenced earlier that's read to the students.

4 3 A Yes.

5 4 Q Now, my -- in your report, there's a number of

6 5 places where you refer to Intelligent Design being

7 6 taught or Intelligent Design being presented. And I can

8 7 tell you that this is the sum total of the presentation

9 8 to students in the classroom. What I'm trying to get at

10 9 here is, does this -- knowing that, knowing that this is

11 10 the sum total of the impact on classroom instruction,

12 11 that follows from the curriculum change, do you have the

13 12 same opinion concerning the decision made by the Dover

14 13 Area School District to present Intelligent Design

15 14 Theory to the students?

16 15 MR. ROTHSCHILD: Object to the form of the

17 16 question. I think it mischaracterized the evidence by

18 17 saying it's the only impact. I will agree that, to

19 18 date, this is -- the statement is the only words said to

20 19 the students in the classroom.

21 20 BY MR. GILLEN:

22 21 Q Okay.

23 22 A With that understanding, I believe, also

24 23 antecedent to this statement, there was a statement in

25 24 the curriculum.

26 25 Q That's true, but the students don't see that.

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1 00137
 2 1 A It doesn't matter.
 3 2 MR. ROTHSCHILD: Object to that
 4 3 characterization.
 5 4 THE WITNESS: It doesn't matter, I think, if
 6 5 the students see it or not. It matters that it's there
 7 6 and it has an effect on teaching, because the teachers
 8 7 are supposed to see it. And therefore, it will
 9 8 determine what and how they present biological topics in
 10 9 the classroom. So it -- I think it does have an effect
 11 10 on instruction.
 12 11 BY MR. GILLEN:
 13 12 Q Tell me what you think -- what effect do you
 14 13 think it has?
 15 14 A Do you have a copy of the statement handy?
 16 15 Q That's it.
 17 16 A In the curriculum?
 18 17 Q No. Oh, that's right there.
 19 18 A I'm sorry. That's the one?
 20 19 Q Yes.
 21 20 A "Students will be made aware of gaps/problems
 22 21 in Darwin's theory."
 23 22 First of all, this is assuming that there are
 24 23 gaps and problems with Darwin's theory, and that these
 25 24 were not already emphasized and/or that they should be
 26 25 emphasized, and that they should be emphasized more than

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1 00138
 2 1 you've --
 3 2 A Okay.
 4 3 Q -- we're -- we're concerned with the
 5 4 presentation of biology and evolutionarily theory in the
 6 5 classroom. And you have a sense that this statement in
 7 6 the curriculum is going to influence that presentation
 8 7 of biology, which is the actual subject matter that's
 9 8 taught in the classroom. And I'm trying to figure out
 10 9 how.
 11 10 A If you presume that teachers are expected to
 12 11 follow the curriculum, then it follows that what is in
 13 12 the curriculum will be what should be taught and,
 14 13 therefore, is taught in classrooms.
 15 14 Q And when you say, "should be taught" and "is
 16 15 taught," are you referring to Intelligent Design?
 17 16 A I'm talking about anything that's in the
 18 17 curriculum. A good teacher's job is to follow what's in
 19 18 the curriculum. Teachers know that if they don't follow
 20 19 what's in the curriculum, they can be reprimanded or
 21 20 even dismissed. So if this is officially in the
 22 21 curriculum, then it must be considered important and it
 23 22 should be followed by the teachers, therefore, it will
 24 23 be pursued in classroom instruction.
 25 24 Q Do you know whether the teachers have been told
 26 25 not to teach Intelligent Design?

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1 00139
 2 1 any gaps in any other theory in science. For example,
 3 2 gravitation, cosmology, relativity, whatever theories
 4 3 are being present. Why is evolution being roped off
 5 4 here and considered separately?
 6 5 Second, this curriculum statement represents
 7 6 that Intelligent Design is a theory, a scientific
 8 7 theory, which it is not, and that is the theory of
 9 8 evolution, which is it not. It is a theory that denies
 10 9 evolution and posits divine intervention.
 11 10 So, I think, to begin with, Pat, that's
 12 11 something that it may be transparent or not seen
 13 12 specifically by students, but it definitely will have an
 14 13 effect on how biology is taught if teachers follow these
 15 14 instructions.
 16 15 Q Well, let me ask you about that, Kevin. What
 17 16 is the impact that you see on the classroom instruction?
 18 17 A One thing, which we discussed before, is that
 19 18 it makes the presumption that Intelligent Design is
 20 19 somehow incompatible with evolutionarily theory, which I
 21 20 think is a religious notion. And it probably isn't even
 22 21 a correct religious notion for most Americans. I'm not
 23 22 really sure that you can admit it here as a statement
 24 23 about science in the first place.
 25 24 Q But, I mean, I'm trying to get focused on the
 26 25 classroom instruction, because you've -- you know,

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1 00140
 2 1 A If they have been taught to teach Intelligent
 3 2 Design, then that countermands what this says in the
 4 3 statement in the curriculum, because it says that
 5 4 students will be made aware of Intelligent Design.
 6 5 Q Okay. Well, let's look at that. I mean,
 7 6 I'm -- let's -- you focus on the curriculum statement,
 8 7 let's look at that. "Students will be made aware of
 9 8 gaps/problems in Darwin's theory."
 10 9 Do you have any understanding concerning
 11 10 whether there are any gaps or problems in Darwin's
 12 11 theory; is there?
 13 12 A There are problems with every theory, but it's
 14 13 all in how you conceive what Darwin said. There are
 15 14 many ways to develop, elaborate, and test what Darwin
 16 15 said, but Darwin is not the only person who has
 17 16 contributed to evolutionarily theory. It's been close
 18 17 on 150 years since the origin of species. A lot has
 19 18 happened since then.
 20 19 Q Sure.
 21 20 A So if you take that entire corpus and say, are
 22 21 there any things that we don't know yet. Well, of
 23 22 course, there are. We could say the same thing about
 24 23 gravitation. Is there a fifth force? That keeps coming
 25 24 up. About relativity. I don't even know what -- a lot
 26 25 of extreme theory and things in physics are, but I know

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1 00141
 2 1 there's lots of problems with every major scientific
 3 2 theory we have. Otherwise, we wouldn't have the need to
 4 3 do it anymore, we could all good home.
 5 4 So these are -- as far as gaps and problems,
 6 5 yeah, there are gaps and problems. We see these things,
 7 6 good things, for inquiry. As opposed to the connotation
 8 7 here, which is clearly, it seems to me, one of
 9 8 deficiencies or inadequacies or incorrectnesses.
 10 9 Q Okay. It's based on that sense that you have,
 11 10 that you find this problematic?
 12 11 A In part.
 13 12 Q What else?
 14 13 A Well, in -- as I've said before, it's -- it's
 15 14 treating Intelligent Design as a theory of evolution.
 16 15 It is telling teachers to make students aware of
 17 16 problems with what they call "Darwin's theory," but not
 18 17 of problems with Intelligent Design, because the
 19 18 prepositions they're using are different. They're made
 20 19 aware of gaps and problems in Darwin's theory. They
 21 20 don't say "and in other theories of evolution." But
 22 21 they say "and of" recurring to -- "students will be made
 23 22 aware of other theories of evolution."
 24 23 There are no other theories of evolution. And
 25 24 to represent that to teachers in a curriculum and ask
 26 25 them to represent that to students in a classroom is

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1 00143
 2 1 means the same thing.
 3 2 Q Where do you get that from, Kevin? What
 4 3 accounts for that?
 5 4 A Vast experience of 25 years of working with
 6 5 creationist literature in California and elsewhere.
 7 6 Work, for example, with my nonprofit. Works with --
 8 7 before the nonprofit was formed when we were trying to
 9 8 keep creation science and anti-evolutionism out of the
 10 9 textbooks in California. That traces back to 1984, '86.
 11 10 Q Do you have an understanding concerning whether
 12 11 Intelligent Design theory takes issue with the origins
 13 12 of life?
 14 13 A Well --
 15 14 MR. ROTHSCHILD: Objection.
 16 15 BY MR. GILLEN:
 17 16 Q Let me -- when you say, "origins of life," what
 18 17 do you mean by that, Kevin?
 19 18 A What I mean -- when scientists speak about the
 20 19 origin of life, they don't use "origins," plural. They
 21 20 mean the first formation of the first living thing way
 22 21 back billions of years ago. We don't mean the origin of
 23 22 man or the origin of birds in the same, somehow, format.
 24 23 We mean the evolution of those things, but where life
 25 24 begins is the origin of life, and it has only one
 26 25 origin, as far as we know. And therefore, in that

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 2 1 fallacious. It's misleading. It's mendacious.
 3 2 Q Now, do you -- let me ask again, Kevin. Do you
 4 3 know whether Intelligent Design is presented as a theory
 5 4 of evolution to students at Dover Area High School?
 6 5 A Whether it has been presented as yet, I don't
 7 6 know. What I'm given to understand is that because
 8 7 teachers refused to follow this directive, that
 9 8 administrators came in and read the following four point
 10 9 or four paragraph statement to the students in the class
 11 10 with no discussion, no objection, and left.
 12 11 Q Okay.
 13 12 A Is that -- that's my understanding.
 14 13 Q That is, and that's accurate.
 15 14 If you look at that four paragraph statement,
 16 15 do you see that statement as holding out Intelligent
 17 16 Design as a theory of evolution?
 18 17 A Yes.
 19 18 Q Where?
 20 19 A In the third paragraph it says, "Intelligent
 21 20 Design is an explanation of the origin of life that
 22 21 differs from Darwin's theory."
 23 22 Darwin's view was not of the origin of life; it
 24 23 was of how species evolved. But in creationist's
 25 24 parlance, the words "origins" and "evolution" are
 26 25 constantly conflated. So this is code language, and it

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 2 1 continuity of life, when we talk about the origin of
 3 2 birds, we mean the evolution of the first birds from
 4 3 things that were already preexisting. But life is
 5 4 coming out of things that are non-life, the study of the
 6 5 origins -- of the origin of life. The "origin of life,"
 7 6 singular, is a very knotty problem that depends on very
 8 7 indirect sketchy evidence that can be formulated, as
 9 8 we've seen, in several different ways. And there are
 10 9 some very interesting and different hypothesis about
 11 10 lots of processes, the origin of life. So when
 12 11 scientists talk about it, it's just the single origin of
 13 12 life billions of years ago.
 14 13 So here, in this paragraph, Intelligent Design
 15 14 is an explanation of the origin of life that differs
 16 15 from Darwin's view. Darwin didn't write his book about
 17 16 the origin of life. He wrote his book about how new
 18 17 species evolved from preexisting species. So these
 19 18 things all become conflated in anti-evolutionist
 20 19 language. And this is typical anti-evolutionist
 21 20 writing.
 22 21 Then they go on to talk about Pandas and People
 23 22 and promote this as a reference for the explanation of
 24 23 life, by which they mean evolution or origins, whatever
 25 24 parlaments they feel like using. This is where the
 26 25 problems lie. Because as -- you asked the question, are

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 2 1 they promoting Intelligent Design. Yes, that third
 3 2 paragraph is entirely about substituting Intelligent
 4 3 Design for a full explanation of Darwinism, or whatever
 5 4 Darwin's theory entails to them, which is really quite a
 6 5 different approach or understanding than scientists
 7 6 have.
 8 7 Q Okay. And again, I want to get a grasp on
 9 8 this. It seems like, looking at that third paragraph or
 10 9 the four paragraph statement, when you see the term
 11 10 "origin of life," you're looking at that in terms of
 12 11 your sort of background knowledge of this creationist
 13 12 evolutionist debate. And you're saying that you
 14 13 understand that term, "origin of life," to be a
 15 14 reference to origin of the species?
 16 15 A It encompasses not just the original origin of
 17 16 life, but also the emergence of major body plants and
 18 17 adaptations, major groups of organisms as well,
 19 18 including humans.
 20 19 Q Okay. And if you look at -- I see that you
 21 20 have this objection that by just referencing the book of
 22 21 Pandas, students are what, they're --
 23 22 A By referencing Pandas, the school board is
 24 23 legitimizing this as a source of knowledge about
 25 24 biological evolution. It's legitimizing the idea that
 26 25 there are scientific alternatives to evolution, and it's

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 2 1 legitimizing Intelligent Design as one of those
 3 2 alternatives.
 4 3 Q Okay. Is there anything else in this statement
 5 4 that you think is problematic, from the standpoint of
 6 5 good science education?
 7 6 A Well, we could talk about why they're confusing
 8 7 the scientific and common uses of the terms "theory" and
 9 8 "fact." And this makes it very problematic because it
 10 9 prejudices, in advance, examination of not just Darwin's
 11 10 theory or the whole theory of evolution, which is way
 12 11 more than Darwin's, but any scientific theory. It gives
 13 12 the impression that the school board believes that a
 14 13 theory, at some point, becomes a fact, perhaps when it's
 15 14 proven or otherwise demonstrated beyond all doubt. That
 16 15 is not at all what we mean in science when we use the
 17 16 terms "fact" and "theory."
 18 17 And if students were given the impression that
 19 18 this is the case, they would be misled. And I believe
 20 19 this would thwart the school board's stated purpose of
 21 20 helping them to prepare well for standardized tests.
 22 21 Q Well, what are you getting at there, Kevin? Is
 23 22 there no distinction between theory and fact?
 24 23 A There is a distinction but, in fact, oddly
 25 24 enough, to a scientist, a fact is a much more trivial
 26 25 thing than a theory. A fact is simply a reported

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 2 1 observation. It could be wrong. Facts are wrong all
 3 2 the time. Facts are not true. The school board's
 4 3 wording gives the impression that a theory becomes a
 5 4 fact. That is, that it becomes true after it has enough
 6 5 evidence to support it. But, actually, a fact is just a
 7 6 small component of a theory. It's an observation. Many
 8 7 observations are made. Many inferences are made. Many
 9 8 hypotheses are drawn from those inferences and tested
 10 9 repeatedly.
 11 10 Many different disciplines can be pursued as
 12 11 they are relevant to exploring the consequences of this
 13 12 building mass of ideas. That eventually becomes a body
 14 13 we call a theory. When it seems like it's a pretty good
 15 14 idea that, for the moment, we're going to -- until
 16 15 something better comes along -- we're very pragmatic
 17 16 about this -- we're going to accept it as the best
 18 17 explanation we have.
 19 18 So a theory, like a theory of -- I guess, I
 20 19 might call platetonics, which emerged from the old idea
 21 20 of continental drift. Platetonics is a theory because
 22 21 it doesn't just say that continents drift around through
 23 22 time, it gives mechanisms for those movements which we
 24 23 didn't have before. It shows how the plates of the
 25 24 earth are drawn back into the earth; how they come up
 26 25 against each other and build mountain ranges; how this

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 2 1 makes earthquakes and volcanoes and rings of volcanoes,
 3 2 for example, as we see around the Pacific continental
 4 3 rims.
 5 4 The consequences of all this don't just apply
 6 5 to the surface, but they apply to our understanding of
 7 6 what goes on deep inside the earth where there are
 8 7 convection currents of heat, heated hot molten rock,
 9 8 hundreds of miles, thousands of miles, thick, coursing
 10 9 through the inside of the earth and erupting and causing
 11 10 these processes on the surface. There, in that whole
 12 11 thing I described, is the embodiment of the theory.
 13 12 Would any single fact come along and slay that theory?
 14 13 It's hard to think of one that would.
 15 14 But the theory itself later on could be
 16 15 modified in any number of ways. Perhaps we'll learn
 17 16 that the relationship of the sun and the moon to earth's
 18 17 gravitational field is what -- that may provide another
 19 18 explanatory mechanism. It may take our focus off
 20 19 convective -- who knows what. We don't know where this
 21 20 is going to go, but the fact is that evolution is a
 22 21 theory that's just like that. We're as certain as we
 23 22 can be that this is a really good explanation of the
 24 23 diversity of life on earth. Does that mean we know
 25 24 everything about it? No. Does it mean we won't find
 26 25 new mechanisms? Of course, we will. Does it mean that

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2 1 existing mechanism we have now, we may find more or less

3 2 important than the past? Of course not. All this, the

4 3 more we study, the more we'll learn. And that's how

5 4 science operates.

6 5 Q In your opinion, is there a possibility that

7 6 that sum total of facts could, at some point, displace

8 7 evolutionarily theory?

9 8 A Because scientists are legendary in being

10 9 open-minded, the answer that I would be expected to give

11 10 is, yes, obviously. But I think I should stress that

12 11 science is open minded, but not empty-headed. And that

13 12 means that we know a lot, and if we have this huge body

14 13 of knowledge, there are two things that could displace

15 14 it. One is, we'd have a bigger body of knowledge that

16 15 says all this is wrong. Or, we could have some other

17 16 observations and ideas that would take that body of

18 17 knowledge, twist it 45 degrees and say, now we can

19 18 explain it this way and it makes even more sense. And

20 19 that's a paradigm shift. But to destroy a whole theory

21 20 like the phlogiston theory -- that's p-h-l-o-g-i-s-t-o-n

22 21 theory -- seems awfully unlikely in view of 150 years of

23 22 research.

24 23 Q The accumulated successes of evolutionarily

25 24 theory is such that you think it's unlikely that it will

26 25 ever be displaced as the reigning theory in this area?

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2 1 A It may be modified, but to be completely thrown

3 2 out, would be unlikely.

4 3 Q If you look at -- I'm sorry, Kevin.

5 4 A And I want to say in fairness, I don't think

6 5 that ID is trying to do that.

7 6 Q What do you see it trying to do?

8 7 A I see it trying to add a certain special kind

9 8 of explanation to the understanding of evolutionarily

10 9 theory. That does not mean that all of its adherence

11 10 accept or do not accept evolution as a fact or

12 11 evolutionarily theory, as we know it today. But it does

13 12 mean they're trying to add another explanation here that

14 13 they think may displace it.

15 14 The language of these documents suggests that

16 15 it is supposed to displace it. And as we discussed

17 16 earlier, it's not clear why Intelligent Design has to be

18 17 in conflict with evolution except that they are positing

19 18 supernatural intervention, which is non-scientific.

20 19 Science can't investigate it. So it comes back to that.

21 20 Q If we stay focused on this theory fact

22 21 distinction, and I look at the bird net hypothesis, how

23 22 does that fit in? Is that a theory; is that a fact?

24 23 A We would call it a hypothesis. That is a

25 24 hypothesis of how this evolved, how this structure

26 25 changed its function.

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2 1 Q So there's neither fact nor theory there?

3 2 A The facts that John used related to the

4 3 structure of the first birds and the animals they came

5 4 from; reasonable inferences about how their arms and

6 5 legs moved, for example, how they could run, how they

7 6 might move their arms; facts about what we knew then

8 7 about the feathers of early birds and possible precursor

9 8 structures.

10 9 So there were, of course, facts that he used to

11 10 develop a hypothesis that then required further testing.

12 11 And as we talked about before, one test of that was

13 12 proposed by our colleagues in Arizona. And it was --

14 13 was persuasive with recourse to the evidence enough to

15 14 suggest to John, and to the others, that maybe his

16 15 proposal was not really explaining very much, and he

17 16 agreed.

18 17 Q Well, and just to get -- you called that a

19 18 hypothesis. Is it not a theory because it unifies a

20 19 lesser range of observations; is that it?

21 20 A Yes.

22 21 Q Okay.

23 22 A It has a much simpler test to it.

24 23 Q So just as I try and labor through this, from

25 24 your standpoint, Kevin, when it says, "Darwin's theory

26 25 is a theory," that is accurate, I guess?

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2 1 A (Witness nods head.)

3 2 Q Is that?

4 3 A Yes.

5 4 Q "It continues to be tested as new evidence is

6 5 discovered."

7 6 A Uh-huh.

8 7 Q That's true?

9 8 A Uh-huh.

10 9 Q The theory is not a fact is literally true, at

11 10 least, but you've expressed these reservations because

12 11 you think it conveys a misleading sense of what the term

13 12 should mean?

14 13 A If someone said, is it a fact that life has

15 14 evolved through time. I would say, yes, because it's a

16 15 well-accepted understanding. Is it a fact that natural

17 16 selection is important in the evolution of life? I

18 17 would say, yes, because it's a well-tested observation

19 18 in natural populations and in laboratory populations.

20 19 We know that selection in these populations can have a

21 20 very strong affect. So we do regard that as a fact,

22 21 that selection is important in evolution.

23 22 Q Okay. So I guess you're saying some features

24 23 of a theory are so well demonstrated that they are a

25 24 fact?

26 25 A Yeah, they're factual. Life has a common

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 2 1 ancestor, and all of life has evolved through time.
 3 2 These are propositions that the scientific community
 4 3 accepts by consensus. I would say, it's not necessary
 5 4 that every scientist in the world accepts all these
 6 5 things, or everyone who calls themselves a scientist
 7 6 accepts all those things, but it is the universal
 8 7 scientific consensus in countries, races, cultures, that
 9 8 operate in science. So the second sentence there is
 10 9 very problematic.
 11 10 Q Then 'gaps in the theory exist for which there
 12 11 is no evidence.'
 13 12 A "Gaps in the theory exist for which there is no
 14 13 evidence."
 15 14 Well, without them saying what the gap is and
 16 15 what particular theory they're talking about, it's
 17 16 really hard to respond to that. It just seems like a --
 18 17 it seems like a kind of a defamatory characterization,
 19 18 and that's all.
 20 19 Q Do you -- I think you told me, but let me ask
 21 20 again. Have you ever spoken with the teachers at Dover
 22 21 about what they taught in the classes dealing with
 23 22 evolution prior to this statement?
 24 23 A I haven't. Sorry, I have not.
 25 24 Q Okay. But do you have an understanding as to
 26 25 whether there are gaps in evolutionarily theory?

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 2 1 enough to tell us, by their rhetoric, what they
 3 2 emphasize, what they deemphasize, what they say and what
 4 3 they don't say. That these paragraphs are largely there
 5 4 to criticize standard evolutionarily theory and to
 6 5 represent that there are other ideas that are scientific
 7 6 that are equally worthy, that somehow are not being
 8 7 presented in the curriculum, but that students can have
 9 8 resource to if they just read the Pandas book. And this
 10 9 is a gross misrepresentation of science and of good
 11 10 science education.
 12 11 Q Because it's holding out Intelligent Design
 13 12 Theory as a scientific theory?
 14 13 A And because it's criticizing standard
 15 14 evolutionarily theory in completely incorrect and
 16 15 inappropriate ways.
 17 16 Q It seems to me, Kevin, what you're saying there
 18 17 is it seems overstated, the criticisms seems overstated?
 19 18 A It's incorrect and biased. It's incorrect to
 20 19 imply that evolutionarily theory is completely in chaos
 21 20 and has big problems with it that students are not being
 22 21 told about in standard curriculum. It's biased in that
 23 22 it does not apply this kind of awareness to any other
 24 23 idea in the science curriculum or indeed, since it's the
 25 24 whole school board, to history, math, social studies. I
 26 25 mean, why don't they have a similar statement that says,

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 2 1 A I'd by that you mean, are there things we don't
 3 2 know yet and are there issues that are still debated.
 4 3 Of course, as there is for any theory. The
 5 4 characterization of these issues in questions as gaps
 6 5 seems to me pejorative and leading.
 7 6 Q And when you say that, Kevin, why do you say
 8 7 that?
 9 8 A It's leading students to believe that things
 10 9 are worse than they are. That there is disarray,
 11 10 perhaps even deception, that they are not being told of
 12 11 problems that exist that are really serious. When, in
 13 12 fact, the problems are not serious. Every evolutionist
 14 13 who writes for the public, from Stephen J. Gould on
 15 14 down, has stress that even though we may argue about
 16 15 whether punctuated or gradualism is more or less
 17 16 important, we do not deny that these organisms are all
 18 17 evolving through time, and they have common ancestors.
 19 18 The insinuation that there is complete
 20 19 disarray, disagreement, chaos, and lack of understanding
 21 20 is simply false. And that is what statements like this
 22 21 purvey having nothing in the statement to balance them.
 23 22 Q And you're making that judgement, Kevin, based
 24 23 on your experience in -- with critics of evolution?
 25 24 A I'm basing it even strictly on what the words
 26 25 in the sentences say here. I think the words alone are

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 2 1 well, the holocaust is one idea. But there's this other
 3 2 idea that the holocaust is a myth, and you can go to
 4 3 this book in your library and read about that.
 5 4 Now, historians, as I understand it, although
 6 5 I'm happy to have you establish that I'm not a
 7 6 historian, would be almost universal in their
 8 7 condemnation of the holocaust myth notion. Yet we find
 9 8 many people in this country who are comfortable with it.
 10 9 If we represent that to children as being an equally
 11 10 good idea about an important history, important event in
 12 11 the last century's history, and that we represented this
 13 12 view has strong evidentiary support for it among the
 14 13 community of scholars that are historians, which should
 15 14 be what we teach in schools, I think that if you made
 16 15 that substitution, a lot of the parents in Dover would
 17 16 say, you know, you're right, this isn't fair.
 18 17 Q And you get the implication from the second
 19 18 paragraph of the statement read to students?
 20 19 A And the third one and the fourth one, which
 21 20 suggests that with respect to any theory, "students are
 22 21 encouraged to keep an open mind." And yet, the board
 23 22 does not address any other theory in any other
 24 23 curriculum or this one. It's only this one that they
 25 24 want students to keep an open mind about.
 26 25 Q When you say that, Kevin, is it based on your

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2 1 understanding that this notion of keeping -- "students

3 2 are encouraged to keep an open mind" is limited to

4 3 evolutionarily theory?

5 4 A This is the only theory under discussion in the

6 5 board's statement.

7 6 Q I think you said there's no -- you're not

8 7 really familiar with any other -- the presentation of

9 8 any other theories in Dover Area High School?

10 9 A I'm not familiar with any other statement the

11 10 school board makes with respect to keeping open minds

12 11 about, or in considering alternative theories that are

13 12 not part of the standard curriculum.

14 13 Q Standard curriculum, meaning what?

15 14 A I presume that the teachers are working either

16 15 from a state curriculum, a district curriculum, or from

17 16 another stand curriculum that the board has accepted as

18 17 something they should be dealing with. In either of

19 18 these cases, I would define those as standard

20 19 curriculum.

21 20 Q Let me ask you, on page 4 of your report,

22 21 you've got the one, two, third paragraph down there, it

23 22 says, if IDC were presented in science class as if it

24 23 were science, and then you number -- number of

25 24 consequences that you see following from that. The

26 25 first is that students would completely misapprehend

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2 1 practice, that sort of practical consequence of that

3 2 curriculum change, would present this harm, that

4 3 "students would completely misapprehend the structure

5 4 and logic of science"?

6 5 A One is tempted to wonder where it would end.

7 6 Do you have the principal coming into the social studies

8 7 class the next day and saying that, well, what you read

9 8 here about European Imperialism and Colonialism in your

10 9 history book is all well and good, but there's another

11 10 theory that actually this is -- this was the manifest

12 11 destiny of a superior European race that had a destiny

13 12 and a legacy to conquer everything in front of it, which

14 13 is the way history was taught in the eyes of the people

15 14 now writing it in decades previously.

16 15 Where will this end if you allow the whim of a

17 16 special-interest-issue group to come in and simply

18 17 countermand or contradict by virtue of the authority of

19 18 a teacher reading this or a school board member or an

20 19 administrator from school, coming in with the bravadoes

21 20 of his position and saying, all of what you're hearing

22 21 now, you know, there's a whole other side to this.

23 22 I find that that's just the poorest education

24 23 practice I can think of. If you really had good

25 24 evidence, it should be presented, assuming that it's

26 25 scientifically valid. And students should understand

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2 1 this structure and logic of science.

3 2 Now, we've gone through this statement, and

4 3 that -- this is, I can tell you, the statement that's

5 4 read at the beginning of the biology classes that deal

6 5 with evolution. Do you believe that the reading of this

7 6 statement would present this harm that I've just

8 7 described from your report, "students will completely

9 8 misapprehend the structure and logic of science"?

10 9 A Well, my paragraph says, Pat, that "if IDC were

11 10 presented in science classes as if it were science." So

12 11 my statements there are not applying specifically to

13 12 simply walking into a classroom and reading this

14 13 statement. So, for all I know, the guy could walk in,

15 14 read the statement, walk out, the kids would go, huh,

16 15 and then just go back to their video games or whatever

17 16 they're doing.

18 17 Q Right. Well, I understand that, and that's why

19 18 I'm asking you. I mean, the situation you described is,

20 19 I think, you can -- let me say for the purpose of this

21 20 question, assume that that's exactly what happened. The

22 21 administrators walked in, they read the statement and

23 22 walked out, and the teachers went on to give

24 23 instruction, and that instruction was an evolutionary

25 24 theory as it had been taught for 20 years at Dover.

26 25 My question is, do you think that that

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2 1 why this is so, and should discuss it. But I think it's

3 2 a matter of established fact among us that there was no

4 3 discussion of this, nor did anyone feel a discussion was

5 4 appropriate.

6 5 Q Well -- and I understand. I'm just trying to

7 6 get a sense for the way in which the report relates to

8 7 what's happening. Just to -- let me ask you, because I

9 8 know you have a background in science education.

10 9 Do you think reading that statement will

11 10 present this harm, that it would have such a dramatic --

12 11 this sounds to -- this is a serious thing, "students

13 12 will completely misapprehend the structure and logic of

14 13 science"?

15 14 And I -- you know, where they ended up is this

16 15 statement. All I want to do is get your opinion. In

17 16 your opinion, as a science educator, does the reading of

18 17 that statement create that harm?

19 18 A I am not persuaded that the reading of that

20 19 statement is the only or ultimate action that the school

21 20 board would take as a result of its curriculum change.

22 21 In the short time that it's been in force, we know that

23 22 the actions of the school board have met tremendous

24 23 resistance and controversy. And that, so far, this is

25 24 all they have felt able to do, perhaps.

26 25 However, the intent and purpose of introduction

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 2 1 to curriculum change is both religiously motivated and
 3 2 scientifically untenable. The effect that this has on
 4 3 instruction is not positive; it's negative. And so I
 5 4 don't feel that it's a relevant question to ask whether
 6 5 what they have done so far is harming anyone. I think
 7 6 that what they would like to do is far more than this
 8 7 and that it would be harmful. As it's done already,
 9 8 it's providing misdirection, falsehoods and
 10 9 misrepresentation of science to students. And you might
 11 10 say that no one's paying attention to it, and I won't
 12 11 agree or disagree.
 13 12 The action as such, is poor science. It's poor
 14 13 pedagogy. It's poor educational practice. And those
 15 14 things are in of themselves harmful.
 16 15 Q Well, look, I understand that, Kevin, I have
 17 16 total respect for you, your credentials, your background
 18 17 in science education, the information you've given me,
 19 18 frankly, here today. And I know why you might suspect
 20 19 that other actions might be taken down the road. I can
 21 20 understand that given the sources of information that
 22 21 you've had. But I just want you to answer that question
 23 22 that I've asked you. Which is, you know, if the -- this
 24 23 reading of the statement, in your opinion, as a science
 25 24 educator, does the reading of that statement create the
 26 25 harm that I've identified here, in your opinion, on page

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 2 1 is, and what -- one thing, for example, is that the
 3 2 Pandas book is full of alleged questions, conundrums,
 4 3 and unsolved problems of evolution, as scientists
 5 4 understand it.
 6 5 These, as I've detailed over many pages, are
 7 6 complete misrepresentations of the science, and they
 8 7 were when the book was written. So I would say for that
 9 8 on the first count, yes, if they did that, they would
 10 9 completely -- if they read Pandas and People, as they're
 11 10 told to do in class, it would completely misrepresent --
 12 11 I'm sorry, they would completely misapprehend the
 13 12 structure and logic of science.
 14 13 Q Would they, if they didn't read Of Pandas?
 15 14 A I can't tell whether they would or would not.
 16 15 It sure wouldn't help.
 17 16 Q How about just the same thing for 2 there,
 18 17 "understanding of evolutionarily biology would be
 19 18 deficient and misinformed"?
 20 19 A Yes.
 21 20 Q "And their training in science would be
 22 21 significantly inferior to that of other schools and to
 23 22 schools in other countries."
 24 23 If we look at the students there, and we posit
 25 24 that they heard the reading of this statement but didn't
 26 25 read Of Pandas, do you think that harm would flow from

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 2 1 4, that students would completely misapprehend the
 3 2 structure and logic of science?
 4 3 MR. ROTHSCCHILD: He's answered that.
 5 4 THE WITNESS: Remembering again, that my
 6 5 statement referred to if IDC were taught as science.
 7 6 But the reading of that statement, if people listened to
 8 7 it, and if a tree falls in a forest and no one hears it,
 9 8 we could debate that, but if people listen to it -- if
 10 9 it is meant to be listened to and heeded, then it would
 11 10 create harm.
 12 11 I cannot tell you if students listen to it and,
 13 12 therefore, if it has created harm. That's not in my --
 14 13 I don't have that experience directly to judge.
 15 14 Q All right. Let me ask you this. If the
 16 15 statement were read, and if the statement was heard by
 17 16 the students, in your opinion as a science educator,
 18 17 would it -- would students completely -- did those
 19 18 students who heard it completely misapprehend the
 20 19 structure and logic of science?
 21 20 A They would -- they would misunderstand,
 22 21 misapprehend what the structure of science is. Because
 23 22 if they heeded the statement, listened to it, and went
 24 23 and read Pandas and People, which is what the statement
 25 24 tells them to do, they would misapprehend what
 26 25 scientific understanding is, what the logic of science

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 2 1 the reading of that statement.
 3 2 A I can't tell.
 4 3 Q How about taxpayer dollars would be wasted? I
 5 4 mean, what's your -- what are you getting at there,
 6 5 Kevin?
 7 6 A When students are introduced to false
 8 7 controversies, when they are told things that are
 9 8 misrepresentations of the understanding that's standard
 10 9 curricular are trying to get across, then tax payers'
 11 10 dollars are wasted. You're wasting time, you're wasting
 12 11 effort, you could be teaching them good science, good
 13 12 social studies.
 14 13 Q On page 6, there's a paragraph that begins,
 15 14 that says, "If school children were taught according to
 16 15 IDC precepts, they would learn that a complex structure
 17 16 would be useless until it was fully formed."
 18 17 When you say, "taught according to IDC
 19 18 precepts," Kevin, what -- what do you have in mind?
 20 19 A Specifically Specified Complexity and
 21 20 Irreducible Complexity, which are the hallmarks of
 22 21 Intelligent Design Creationism, as we understand it.
 23 22 Q Do you have any understanding concerning
 24 23 whether the students at Dover High School are taught
 25 24 those concepts?
 26 25 A You tell me that, so far, only this statement

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1 has been read to them. I respond that, if down the line Intelligent Design were taught as if it were a scientific theory and as if it were an alternative evolution, then these things would happen.

Q The reading of the statement alone, would that -- would they learn that a complex structure would be useless until it is fully formed or was fully formed, the statement?

A The four paragraph statement by itself doesn't address those specifics.

Q You've got a reference here to -- as that sentence goes on, to the evidence for that a wing would be useless until it was fully formed, and that this is, therefore, evidence of a miraculous intervention of a Master intellect or Creator. If, as I tell you, just for the purposes of these questions, we're limiting to the statement, is that harm still present, in your judgment?

MR. ROTHSCHILD: Just to be clear, this posits a student who does not go and read Pandas?

BY MR. GILLEN:

Q Right.

A If a four paragraph statement states the term "Intelligent Design," and relates it to discussions about the origin and evolution of life. In those four

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1 from the Board's action of taking an unproblematic, straightforward concept, universally accepted by scientific societies and the consensus of scientists, and pretending that it's riddled with problems, and that there's an alternative idea that should be taught alongside it, and should be done.

I believe if you wish to say, did this action alone create harm, it is not just this action, but the passage of these actions by the Board and the strife and turmoil that has existed and resulted in that community, as a result of this action, that is going to leave a scar on that community for a long time to come no matter how this is decided. And I have to ask myself, is it all worth it to try to take this little special pleading that's not even wrong. It's not even wrong because it's not even science. And to say here, we have to put this on equal footing. What kind of good can that action have inside and outside of the classroom?

I do not feel it is fair to judge the consequences of the Board's action simply by whether reading the statement in the classroom has caused harm. What has happened in the Dover community, if news reports and everything that you and I hear is any indication, it's a turmoil and confusion, and a misrepresentation that could have been completely

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1 paragraphs themselves, they do not directly address the specifics of miraculous interventions.

Q Now about -- I mean, I just -- you ventured a number of opinions related to the teaching of some Intelligent Design concepts, Irreducible Complexity or Specified Complexity. As -- I don't want to belabor the process. The statement doesn't get into that, this is what they ended up with. Does -- in your judgment now, if you look at the situation as it's actually, you know, occurred, what's -- what's the end result of this contest between the Board and different facets of the community, does it present the harms that you were concerned about when you drafted your expert report?

MR. ROTHSCHILD: Objection, asked and answered.

THE WITNESS: I think that we -- if we can admit, as agreed, that so far this statement has been read by administrators, not teachers, and these administrators then left the classroom, and teachers went on with whatever they were doing, then we also should be able to admit the fact that, as I understand it, there has been a lot of heated controversy and argument in the Dover community at school board meetings and super market aisles, who knows, on telephone calls among people. And who knows the extent of the confusion, misunderstanding and damage that has resulted

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1 avoided.

Q Okay. Those are sort of extra science education considerations?

A I don't think so, because I don't think that students only learn in the classroom. I think that they learn a lot from discussions that they have and that they hear outside the classroom. And if this buzz in the community is anywhere near as great as news report would have us understand, you wonder who is guiding that discussion outside the class, which is probably far more than the discussion in class. What other kinds if -- excuse me.

If the Dover School Board can be so uneducated and misled about basic science as to take actions like this, what about the other people in the community who don't have their experience and wisdom? I presume that they're on the board because they're regarded as educational leaders in their community. If that's the case, what about the people that don't have their breadth of knowledge and experience? What kind of discourse is being fostered by this confusion among all those people who have no authorities to turn to?

Q Let me understand you. Is it your view that any discussion of Intelligent Design is harmful?

A No. Rather, that the actions of the board have

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2 1 created a false controversy about science and science

3 2 education that have repercussions beyond the time it

4 3 takes or the form that it represents to read four

5 4 paragraphs by an administrator in a science classroom.

6 5 And I think it would be negligent not to

7 6 acknowledge that or try to limit the problems or the

8 7 damage to what happens to a few students that hear

9 8 somebody read this in a classroom.

10 9 Q If we focus on the students hearing the

11 10 statement read, as we sit here today, are there any

12 11 other harms that you can see inuring to those students

13 12 in the classroom that follow from the reading of these

14 13 statements?

15 14 A I believe you would have to ask those students

16 15 and their parents and the other members of their

17 16 community.

18 17 Q Kevin, on page 14 of your report, you say that

19 18 "IDC proponents reject the standard methods of science."

20 19 A Yes.

21 20 Q Just give me a sense for what you're

22 21 understanding is in that regard, what methods do they

23 22 reject?

24 23 A One method, that it restricts examination to

25 24 natural phenomena, not supernatural ones.

26 25 Q Any others?

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2 1 A One method of science is, when possible, either

3 2 to set up experiments and to carry them out. I have not

4 3 seen any experiments carried out with reference to IDC.

5 4 Another method would be to use phylogenetic comparative

6 5 methods to examine whether the evolution of the

7 6 structure could occur or whether, for example, it was

8 7 too complex or had too much Specified Complexity to

9 8 evolve. I've seen no work done or submitted according

10 9 to those methods. And I think one method that applies

11 10 to the scientific community that is important to stress,

12 11 is its submission to peer review, which has never been

13 12 done, as far as I know.

14 13 Q Any other methods?

15 14 A I can't think of specific cases right now.

16 15 They may come up in further discussion.

17 16 Q Let me just ask you. Now, if we contrast that

18 17 with Darwinian theory, as it's called in the statement.

19 18 Evolutionarily theory, I think, as it's known,

20 19 apparently, in the professional community today, is that

21 20 falsifiable?

22 21 MR. ROTHCHILD: Objection to the form.

23 22 THE WITNESS: However we characterize our

24 23 evolutionarily theory or Darwinian theory, to say that a

25 24 theory is falsifiable would suggest that everything

26 25 about it is wrong. Is it testable, are aspects of it

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2 1 testable and even falsifiable? Yes, of course, sure.

3 2 BY MR. GILLEN:

4 3 Q Could there -- let me -- I'm trying to get a

5 4 sense for how -- plainly, you see this differentiation

6 5 here between Intelligent Design Theory and

7 6 evolutionarily theory. And we've -- at several points

8 7 today, we've talked about it being testable or parts of

9 8 it being testable. And you have the conviction that

10 9 there's no testable elements to Intelligent Design

11 10 Theory; is that correct?

12 11 A What I said is, that the supernatural part of

13 12 it is not testable scientifically, because science's

14 13 purview is only in the natural world. These things may

15 14 or may not be true, but they are not part of science.

16 15 Q Are there other parts that are testable?

17 16 A There are parts that may or may not be

18 17 testable, but they have not been proposed in the

19 18 scientific community in testable terms. And that's why

20 19 we talked about the idea that Behe and Dembski, for

21 20 example, have said certain things or they have written

22 21 certain things, but they have not subjected this to peer

23 22 review. And even when they've been criticized, they

24 23 have not responded in many respects, a problem of which

25 24 their critics complain. And so, what these guys seem to

26 25 want is -- is "double indemnity" the right word, maybe

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2 1 not. They want it both ways. They want to be able to

3 2 come in and say that they've got the greatest thing

4 3 since sliced bread, but they don't want to say that in

5 4 the scientific form, and they don't want to respond to

6 5 scientific criticisms in a scientific form.

7 6 If this is the case, why is this science? The

8 7 process, the de facto nature of science, this isn't it.

9 8 This isn't it. They're not doing it.

10 9 Q Now, just so I get you, you're contrasting that

11 10 with evolutionarily theory, where you said that parts of

12 11 it are testable?

13 12 A I can think of probably a dozen journals off

14 13 the top of my head, in which every aspect of

15 14 evolutionarily theory is routinely reported, tested,

16 15 modified, enlarged, expanded, and in some cases,

17 16 rejected.

18 17 Q Okay. But those, as you see it, apparently,

19 18 they have no implications for the over arching thrust or

20 19 tenants of evolutionarily theory; is that fair?

21 20 A No. They have every bit as much.

22 21 Q You're right. My question was imprecise. But

23 22 in terms of falsifying the theory, they don't pose

24 23 significant challenges to the overall standing of the

25 24 theory?

26 25 A Sure they do. Sure. We can take any number of

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 2 1 components of evolutionarily theory, and they're being
 3 2 challenged all the time. Punctuated equilibria
 4 3 challenged that notion that the prevailing pattern of
 5 4 evolution is slow and gradual. That's a huge challenge.
 6 5 It was regarded as such. In fact, it was regarded as a
 7 6 greater challenge than its proponents suggested. They
 8 7 thought they were doing everybody a favor and saying,
 9 8 hey, look guys, here's the way things really change, and
 10 9 you know what, it agrees more with your modern models of
 11 10 speciation than with the old outmoded ideas that we used
 12 11 to think about, so.
 13 12 Q Do you have any sense that evolutionarily
 14 13 theory, as such, can be falsified through the
 15 14 accumulation of these tests?
 16 15 A Do you mean that the entire structure and
 17 16 corpus of evolutionarily theory can be falsified?
 18 17 Q Yeah.
 19 18 A Well, it's funny to say so, but in theory, yes.
 20 19 That is to say, of course, everything we think now can
 21 20 be modified and changed so as to be different from the
 22 21 way we've seen it. Is Intelligent Design likely to do
 23 22 that? Certainly, it shows no sign of it so far.
 24 23 MR. GILLEN: I have no further questions.
 25 24 MR. ROTHSCHILD: Mini script and ASCII and
 26 25 exhibits. You'll get the original exhibits.

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 2 1 MR. GILLEN: She'll put a copy on the original,
 3 2 and I'll take the same.
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 8 I, KEVIN PADIAN, do hereby declare under
 9 penalty of perjury that I have read the foregoing
 10 transcript of my deposition; that I have made such
 11 corrections as noted herein, in ink, initialed by me,
 12 or attached hereto; that my testimony as contained
 13 herein, as corrected, is true and correct.
 14 EXECUTED this ____ day of _____
 15 2005, at _____ (City) _____ (State)
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KEVIN PADIAN

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 2
 3 I, the undersigned, a Certified Shorthand
 4 Reporter of the State of California, do hereby certify:
 5 That the foregoing proceedings were taken
 6 before me at the time and place herein set forth; that
 7 any witnesses in the foregoing proceedings, prior to
 8 testifying, were placed under oath; that a verbatim
 9 record of the proceedings was made by me using machine
 10 shorthand which was thereafter transcribed under my
 11 direction; further, that the foregoing is an accurate
 12 transcription thereof.
 13 I further certify that I am neither
 14 financially interested in the action nor a relative or
 15 employee of any attorney of any of the parties.
 16 IN WITNESS WHEREOF, I have this date
 17 subscribed my name.
 18
 19 Dated: _____
 20
 21
 22 ANA VIDA REID
 23 CSR No. 11926
 24
 25

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